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Benjamin Peirce.

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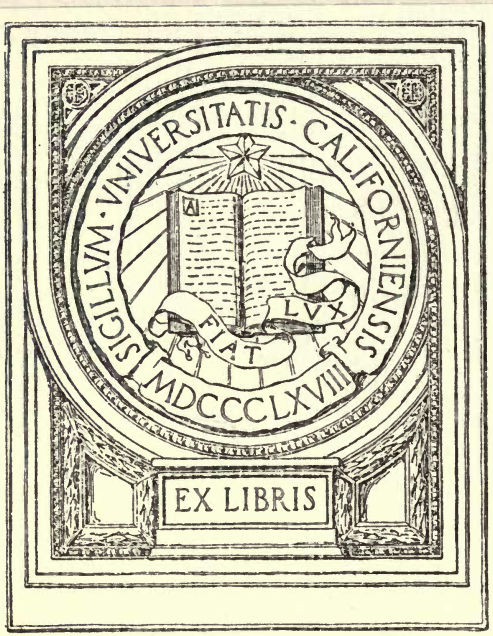
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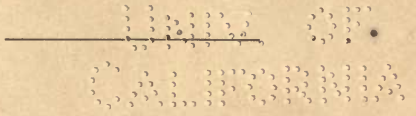
BENJAMIN PEIRCE.

Judge the tree by its fruit. Is this magnificent display of ideality a human delusion? Or is it a divine record? The heavens and the earth have spoken to declare the glory of God. It is not a tale told by an idiot, signifying nothing. It is the poem of an infinite imagination, signifying immortality.

BENJAMIN PEIRCE.



A MEMORIAL COLLECTION,

BY MOSES KING.

CAMBRIDGE, 1881. MASSACHUSETTS.

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BEN DELL' INTELLETTO.

WHENEVER *Good of Intellect* comes in,
Then peace is with us, and a soft control
Of all harsh thinking, and but one desire
Fills every bosom, — to forget the din
Of outside things and render up the soul
To friendship's banquet by an evening fire:
Then is the season in this world of sin
That brings new strength and keepeth us heart-whole
Amid the changes that distress and tire;
And when from wisdom we have wanderers been,
So that a stupor on the spirit stole
From things unknown,[1] with visions dark and dire,
In this high presence we restore ourselves
More than by all the volumes on our shelves.

THOMAS WILLIAM PARSONS.

[1] "E stupor m'eran le cose non conte." *Purgatorio*, XV., 12.

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INTRODUCTION.

THIS little volume is no biography of the great man who a short time ago closed an active career of almost fifty years in the service, nominally of astronomy and mathematics at Harvard University, but practically of science and religion throughout the world. Its contents but feebly reflect the life of one who ranks among the few men whose names have been imperishably recorded in the annals of science and religion in this century. At best it can only serve as a convenient reference-book for the future biographer of the late professor.

Although having neither the ability to appreciate the extraordinary intellect of Professor Peirce, nor an acquaintance long enough to write a personal narrative of his life, I could have re-written what had already appeared in print, and thus have issued a so-called biography; but it seemed best simply to gather in permanent and convenient form such printed matter as was occasioned by the death of Professor Peirce, correcting such errors as had crept in, omitting, as far as possible, such parts as were repetitions, and adding a few notes on his last illness, and a brief account of the funeral.

My acquaintance with Professor Peirce was very short, yet long enough to make me always regard him as one of my kindest friends. At a time when there were quite different opinions among the officers of the University as to the propriety of my issuing *The Harvard Register*, he, who for almost half a century had devoted himself to the institution, unhesitatingly came forward in support of the new enterprise. He aided it pecuniarily, offered many valuable suggestions, indorsed it publicly, and promised to contribute occasional articles. To him I am indebted for the last piece of work that he was permitted to write for publication. It was his article on "The Intellectual

Organization of Harvard University." Although brief, it contains many thoughts that will remain as permanent maxims. It gives in a convincing manner some indisputably correct opinions on the duties of the students, instructors, and administrative officers of a true university.

His kindnesses were experienced also by other students; and, whatever may be said of his failure to be instructive to those who could not comprehend his teaching, no one ever complained that he was severe upon those who failed to profit by it, while there are many to give hearty praise for his sympathy with them in their difficulties with their college work. He realized that a student's career at college, especially where all studies are prescribed, is not necessarily an infallible sign of his success in later life, and kindly interceded with the faculty in behalf of many students who were unable to master their prescribed work.

It is therefore chiefly from a feeling of sincere gratitude to one of the noblest men that it has ever been my lot to meet, that I have issued this simple compilation. M. K.

CAMBRIDGE, January, 1881.

FROM PLATO.

Ἀστὴρ πρὶν μὲν ἔλαμπες ἐνὶ ζωοῖσιν Ἑῷος,
νῦν δὲ θανὼν λάμπεις Ἔσπερος ἐν φθιμένοις.

Peirce! among living men thou morning star!
Shin'st Hesperus now where souls departed are.

OCT. 9, 1880. T. W. PARSONS.

BENJAMIN PEIRCE.

BY EX-PRESIDENT THOMAS HILL, D.D., LL.D.

[From *The Harvard Register*, May, 1880.]

No name has shed a more brilliant lustre over the academic department of Harvard College, during the last thirty-five years, than that of Benjamin Peirce, of the class of 1829. He was born at Salem, April 4, 1809; was appointed tutor in 1831, University professor of mathematics and natural philosophy in 1833, Perkins professor of astronomy and mathematics in 1842. Tutor Henry Flynt (1693) is the only person ever connected with the College for a longer period. From 1836 to 1846 he issued a series of text-books on geometry, trigonometry, algebra, and "curves, functions, and forces." They were so full of novelties that they never became widely popular, except, perhaps, the trigonometry; but they have had a permanent influence upon mathematical teaching in this country; most of their novelties have now become common-places in all text-books. The introduction of infinitesimals or of limits into elementary books; the recognition of direction as a fundamental idea; the use of Hassler's definition of a sine as an arithmetical quotient, free from entangling alliance with the size of the triangle; the similar deliverance of the expression of derivative functions and differential co-efficients from the superfluous introduction of infinitesimals; the fearless and avowed introduction of new axioms, when confinement to Euclid's made a demonstration long and tedious, — in one or two of these points European writers moved simultaneously with Peirce, but in all he was an independent inventor, and nearly all are now generally adopted.

All his writings are characterized by singular directness and conciseness, and particularly by a happy choice of notation, — a point of great importance to the mathematician, lessening not only his mechanical labor in writing, but also his intellectual labor in grasping and handling the difficult conceptions of his science.

His text-books were also complained of for their condensation, as being therefore obscure; but under competent teachers their brevity was the cause of their superior lucidity. In the Waltham High School his books were

used for many years, and the graduates attained thereby a clearer and more useful applicable knowledge of mathematics than was given at any other high school in this country; nor did they find any difficulty in mastering even the demonstration of Arbogast's Polynomial Theorem, as presented by Peirce. The latter half of the volume on the Integral Calculus, full of marks of a great analytical genius, is the only part of all his text-books really too difficult for students of average ability.

Gill's Mathematical Miscellany contained many contributions which showed in a singular light the Harvard professor's power. For example, in the issues for May and November, 1839, he solved, by a system of co-ordinates of his own devising, several problems concerning the involutes and evolutes of curves, which would probably have proved impregnable by any other mode of approach.

During the year 1842, Professors Peirce and Lovering published a "Cambridge Miscellany of Mathematics and Physics," in which Peirce gave an analytical solution of the motion of a top, a criticism of Espy's theory of storms, etc. About the same time he adapted the epicycles of Hipparchus to the analytical forms of modern science; and the method was used by Lovering in meteorological discussions communicated to the American Academy.

The comet of 1843 gave Professor Peirce the opportunity by a few striking lectures in Boston to arouse an interest which led to the foundation of the Observatory at Cambridge; and by his discussions of the orbit with Sears C. Walker, he and that remarkable computer were brought to mutual acquaintance, and prepared for the still more important services to astronomy which they rendered after the discovery of Neptune. This planet was discovered in September, 1846, in consequence of the request of Leverrier to Galle that he should search the zodiac in the neighborhood of longitude 325° for a theoretical cause of certain perturbations of Uranus. But Peirce showed that the discovery was a happy accident; not that Leverrier's calculations had not been exact, and wonderfully laborious, and deserving of the highest honor; but because there were, in fact, two very different solutions of the perturbations of Uranus possible: Leverrier had correctly calculated one, but the actual planet in the sky solved the other; and the actual planet and Leverrier's ideal one lay in the same direction from the earth only in 1846. Peirce's labors upon this problem, while showing him to be the peer of any astronomer, were in no way directed against Leverrier's fame as a mathematician: on the contrary, he testified in the strongest manner that he

had examined and verified Leverrier's labors sufficiently to establish their marvellous accuracy and minuteness, as well as their herculean amount.

A few years later, 1851 to 1855, Peirce published the remarkable results of his labors upon Saturn's rings. Professor G. P. Bond had seen the ring divide itself and re-unite, and had thereby been led to show by computation from Laplace's formulæ that the ring could not be solid. Upon this Peirce investigated the problem anew, and showed that the ring, if fluid, could not be sustained by the planet; that satellites could not sustain a solid ring, but that sufficiently large and numerous satellites could sustain a fluid ring, and that the actual satellites of Saturn are sufficient.

In 1849 he was appointed consulting astronomer to the American Ephemeris and Nautical Almanac, and rendered efficient service in bringing that publication to its condition of honorable authority; particularly in the lunar tables which he furnished, in his treatment of Neptune, and various methods of computation. He also assisted Professor Bache in the Coast Survey, and was, for many years, of great service in that important national work, before he was himself appointed superintendent in 1867. His calculations of the occultations of the Pleiades were very laborious and exact, and furnished an accurate means of studying the form, both of the earth and her satellite; his criterion for rejecting doubtful observations is an ingenious and valuable extension of the law of probabilities to its own correction; his detection of the mental error of lurking personal preferences for individual digits is a curious specimen of that acuteness of observation which characterizes his own mind.

He held the office of superintendent of the Coast Survey from 1867 to 1874. Coming after such able men as Hassler and Bache to an office which required not only familiarity with mathematics and physics, but also great knowledge of men and executive ability, he was not found wanting, but showed that the theory of the Stoics will sometimes hold good to-day, — the really great man shows himself great by any and every standard. The Coast Survey has, since the year 1845, steadily advanced in public favor; and its work commands the highest respect among all men competent to judge throughout the world, as being not only of direct service to the nation, but as making constant valuable additions to science.

Many monographs, bearing the marks of Peirce's individuality and peculiar power, have been read by him before various academies, societies, and institutions; but only the results of most of them have ever been furnished for publication. Among these may be mentioned an investigation of the forms of stable equilibrium for a fluid in an extensible sack floating in anoth-

er fluid, being an *a priori* embryology. Also, the motions of a billiard-ball, an instance in nature of discontinuity, when the ball leaves its curve, and goes on a tangent; another, the motion of a sling, curious from the immense variety of forms comprised under exceedingly simple uniform conditions.

In 1857 he published a volume summing up the most valuable and most brilliant results of analytical mechanics, interspersing them with original results of his own labor. A year or two later an American student in Germany asked one of the most eminent professors there, what books he would recommend on analytical mechanics: the answer was instantaneous, "There is nothing fresher and nothing more valuable than your own Peirce's recent quarto." In this volume occurs a singular instance of a characteristic which I have already mentioned. Peirce assumes as self-evident that a line which is wholly contained upon a limited surface, but which has neither beginning nor end on that surface, must be a curve re-entering upon itself. By means of this hyper-Euclidean axiom he reduces a demonstration which would otherwise occupy half a dozen pages to a dozen lines.

In 1870, through the "labors of love" of persons engaged on the Coast Survey, an edition of a hundred lithographed copies was published, of certain communications to the "National Academy" upon "Linear Associative Algebra." In 1852 Hamilton of Dublin had published his wonderful volume on Quaternions; and this had been followed by various other attempts to create an algebra more useful in geometrical and physical research than the co-ordinates of Descartes. Ordinary algebra deals only with quantitative relations; and the object of the Arithmetic of Lines, and of Cartesian co-ordinates, had been to reduce distances and directions to a comparison of quantity. But Hamilton introduced quality also; and his algebra employed the dimensions of space, unchanged and essentially diverse, in computation. His imitators and followers had not succeeded in improving, or in really adding to, his methods. But Peirce, in these communications to the Academy, attacks the problem, according to his wont, with astonishing breadth of view, and boldness of plan. He begins with a definition of mathematics, shows the variety of processes included in his definition, passes then to its symbols, shows the nature of qualitative and of quantitative algebras, and of those which combine the two, and says he will investigate the general subject of algebra. First, he limits himself in this volume to algebras handling less than seven distinct qualities; that is, not exceeding six. The notation is then discussed, and the necessary enlargements and modifications of the algebraic signs and symbols are clearly defined. The distributive and asso-

ciative principles in multiplication are adopted, but not the commutative: and he confines himself to linear algebras; that is, to those in which every expression is reducible to an algebraic sum of terms each expressive of a single quality. After a full discussion of the general results which must be found in all algebras under these conditions, he begins with single algebras, then double, then triple, and so on up to sextuple, making nearly a hundred algebras which he shows to be possible, and of which he gives the great features. There are almost no comments upon them; and it is only by a patient examination for himself that the reader discovers, that, of all these numerous algebras, only three have ever been heard of before. First, of the two single algebras we have one, which is the common algebra, including its simpler form of arithmetic. Secondly, of the three double algebras we have one, viz., the Calculus of Leibnitz and Newton. Thirdly, of over twenty quadruple algebras, only one has been used, the Quaternions of Hamilton. Such is a brief abstract of this book of marvellous prophecy. The most noteworthy things which he has done since its publication are a course of Lowell lectures, given about a year ago, on "Ideality in Science," and a series of communications to the American Academy, which, it is understood, is still to be continued. In the Lowell lectures he embodies many of his views on philosophy and religion which are peculiarly dear to him, and are always listened to with profound interest, even by those of less religious nature. In the communications to the Academy he is discussing, with all his wonted power, questions of cosmical physics, and particularly theories concerning the source and supply of the sun's heat.

While Professor Peirce has the tenacity of grasp, and power of endurance, which enable him to make the most intricate and tedious numerical computations, he is still more distinguished by intensity and fervor of action in every part of his nature, an enthusiasm for whatever is noble and beautiful in the world or in art, in fiction or real life; an exalted moral strength and purity; a glowing imagination which soars into the seventh heavens; an insight and a keenness of external observation which makes the atom as grand to him as a planet; a depth of reverence which exalts him while he abases himself.

NOTE.

At the time the foregoing excellent sketch was written, Professor Peirce seemed to be unusually well. For several years the state of his health had occasionally caused his friends some anxiety, but they now thought that it was well established again. The time had by no means come when those who knew him, either in his public or his private life, could find reason to feel that he had begun to approach the end of this world's usefulness or enjoyment. He was still in the fulness of his faculties, of his judgment, of his interests, and of his affections; and seemed to be entering on a new period of vigorous, fresh, and serene life. During the winter of 1879-80 and the ensuing spring, he was active in many directions. He was the chief mover in a series of weekly scientific meetings among the corps of the University, in which he not only sought to stimulate a searching discussion of the questions of cosmical physics he was himself enthusiastically studying, but warmly welcomed the topics which others brought forward, with the unfailing interest he always showed in every true line of investigation. With the assistance of a favorite pupil, he resumed but too earnestly (for the zest with which he threw himself into this work brought on his first attack) the study of the comet of 1843, and undertook the complete inquiry into all its successive appearances from the beginning of astronomical records, incited thereto by hearing of the remarkable observation, strongly recalling that comet, made in South America by his friend Dr. Benjamin Apthorp Gould. He was still deeply interested in his work of teaching, and had announced an important new course on cosmical physics for the current year; and his teaching, whatever its defects in the view of the mere pedagogue, and even from a higher standpoint, had in it elements of originality,

of power, of rapid vigor, of profundity, of intrinsic clearness (sometimes marred, it is true, by superficial obscurity), of unfaltering freedom, and of life, which no instruction, proceeding from less remarkable intellect or learning, could approach. In his prime he was the centre of an influence which went to the starting of many a since distinguished scientific career; and he was happy in having, to the last, pupils who understood the greatness of his teaching, and appreciated and loved his character.

While he thus seemed to be renewing his scientific activity, his interest in literature, art, and society, appeared also greater than ever. He repeated his Lowell Lectures in Baltimore, and one of them in New York, and heartily enjoyed both the social pleasures of his visit, and the interest he was able to awake. He entered, with delightful freshness, into the enjoyment of the exquisite presentations of Shakspeare's heroines which adorned our stage last spring, and of the noble and deeply imagined characterizations of the great actor who followed; in honor of whom, and of that musician of delicate perceptions and fascinating presence whose life has since closed, his last hospitality was offered. He was eager to let no opportunity go by of rendering a service or a gratification to a friend; and he took every occasion of reviving with cordiality friendships and associations of long-past days. But it is not unlikely that this increased activity was but a pressing forward, enforced by a presentiment of the shortness of the time, and that all the while he was himself looking with steady eye to the approaching end.

In May Professor Peirce began to pass under the shadow of the cloud of his last illness. For some weeks there was little serious fear that it was a shadow not destined to lift. He was first confined to his chamber on the 25th of June; and from that time his slowly failing condition was hardly relieved even by any deceptive appearances of improvement. He died on the morning of Wednesday, Oct. 6. Distinguished throughout his life by his freedom from the usual abhorrence of death, which he never permitted himself either to mourn when it came to others, or to dread for himself, he kept this characteristic temper to the end, through all the sad changes of his trying ill-

ness; and, two days before he ceased to breathe, it struggled into utterance in a few faintly-whispered words, which expressed and earnestly inculcated a cheerful and complete acceptance of the will of God with regard to him.

The funeral took place on Saturday, Oct. 9, at Appleton Chapel, and was the occasion of an impressive gathering of people of great and various mark. The attendance included a very full representation of the various faculties and governing boards of the University; a large deputation of officers of the United-States Coast and Geodetic Survey, headed by the superintendent and the chief assistant; delegations of eminent professors from Yale College and the Johns Hopkins University; many members of the class of 1829; and a great number of other friends of the deceased. The pall-bearers were: —

President Charles W. Eliot.
Ex-President Thomas Hill, Pastor of the First Parish Church, Portland, Me.
Capt. C. P. Patterson, Superintendent of the United-States Coast Survey.
Professor J. J. Sylvester, of the Johns Hopkins University.
Hon. J. Ingersoll Bowditch.
Professor Simon Newcomb, Superintendent of the *American Ephemeris and Nautical Almanac*.
Dr. Oliver Wendell Holmes.
Professor Joseph Lovering.
Dr. Morrill Wyman.

A beautiful and simple service was conducted by the Rev. A. P. Peabody and the Rev. James Freeman Clarke; nor could any thing be more congenial to the sentiments of those who were familiar with Professor Peirce's own character and tastes than the expression that was given in music, and which nothing but music could so fully give, to the feeling of the hour, through the chant and the organ, and by one moving voice, inspired by memories of affectionate interest and genial sympathy and admiration to its noblest utterance.

It was a day brimming with the sweet magnificence of autumn, — its generous and tender gladness in truest harmony with the bright, rich, and ever-youthful nature of him whose image filled so many hearts.

X. Y. Z.

RESOLUTIONS.

ACTION OF THE PRESIDENT AND FELLOWS.

At a meeting of the President and Fellows of Harvard College, Oct. 11, 1880, the following entry was made upon the record: —

"The President and Fellows desire to express their deep regret at the death of Benjamin Peirce, Perkins Professor of Astronomy and Mathematics, on the 6th inst., in the seventy-second year of his age, and the fiftieth of his service as a College teacher.

"The University must long lament the loss of an intelligence so rare, an experience so rich, and a personal influence so strong, as his.

"As a teacher, he inspired young minds with a love of truth, and touched them with his own enthusiasm; as a man of science, his attainments and achievements and his public services have reflected honor upon the University and the country."

ACTION OF THE FACULTY OF HARVARD COLLEGE.

At a meeting of the Faculty held Nov. 15, 1880, it was voted to enter the following on the Faculty Records: —

"The Faculty of Harvard College desire to put on record their sense of the loss which they, individually and collectively, have sustained in the death of Professor Benjamin Peirce, in the fiftieth year of his service as a teacher and as a member of this body.

"Gifted with an extraordinary intuition in his favorite science, he was eager to lead where few were able to follow; but all felt the inspiration of his profound thought and earnest utterance. With full consciousness of his own powers, he over-estimated the abilities of others. Those who came into intimate contact with him were attracted by the simplicity of his nature and

elevated by the nobility of his mind. His more public services to science and to the country have given him a wider reputation than belongs to the teacher; but the College has a portion in the heritage of all her illustrious sons."

ACTION OF THE AMERICAN SOCIAL SCIENCE ASSOCIATION.

At a meeting of the executive committee of the American Social Science Association, held at Boston, Oct. 27, 1880, President Wayland in the chair, the following resolutions were adopted, and entered on the records of the Association:—

Resolved, That the American Social Science Association, in the death of Professor Peirce, mourns the loss of a distinguished member, who added to those special gifts and attainments by which he was known to the world, a broad interest in all forms of human knowledge, and all subjects of scientific research, which made him in a peculiar manner the representative of social science among those whose function was education and the general culture of mankind. Coming to our main work late in life, and impelled by his sympathy with all the forward movements of human intelligence, he brought with him and imparted to others that deep religious enthusiasm which is so essential in these universal studies, and which gives to the matured wisdom of age its most attractive aspect.

Resolved, That the official service of Professor Peirce, in guiding and carrying forward the educational work of this Association, has been seasonable and important; and that his death leaves vacant a place in its councils which we shall vainly seek to fill; while his example remains in memory, a cordial encouragement to youth, and a steady light for the experience of age.

REPRINTS FROM PUBLICATIONS.

FROM THE BOSTON *DAILY ADVERTISER*, OCT. 7.

AN editorial notice in the Boston *Daily Advertiser*, on the morning of Oct. 7, said, —

"The death of Professor Benjamin Peirce is a great and national loss; for he was the Nestor of American mathematicians, and the historic transition from the illustrious Nathaniel Bowditch to the present generation of mathematical minds. And among these the son of the deceased, Mr. Charles Sanders Peirce, is not so much the rising hope as he is the worthy heir of great traditions. If Newton and Gauss are the greatest of modern mathematicians, the late Professor Peirce's merits will rank with the marvellous achievements of the Bernoullis, Euler, and Laplace. For not only has he extended the field of mathematics, he has also re-surveyed the larger part of the field, and by the introduction of new methods enabled his successors to cover more ground in less time than was previously possible. This is shown, even in his elementary treatises, in his treatise on analytical mechanics of 1857, and in his 'Linear Associative Algebra' of 1870. Had he chosen to publish a selected edition of his mathematical works satisfactory to himself, there is reason to believe that for centuries to come the world would not willingly let them die. The layman's impression, that a science as precise and formal as mathematics is necessarily dry and abstract, is not borne out by Professor Peirce's works and his personal character. Both were to a remarkable degree imaginative, speculative, and emotional. Both were filled with that reverence which is the almost uniform result of having felt the living pulse of everlasting truths. Nor has Professor Peirce's life been spent in learned retirement. He was among the teachers at Round Hill; since 1831 he has been one of the bright, particular stars of Harvard College; the Harvard Observatory was founded through his help; he was next to Bache the strongest man connected with the United-States Coast Survey; he helped in making the *American Ephemeris* an authority rarely challenged;

he contributed to the transactions of the National Academy, the American Academy, and other learned societies; and he was of value wheresoever he chose to mingle with his fellow-citizens. For as was his science, true and pure, so was the man."

In the news department of the same paper appeared an obituary sketch of Professor Peirce. The following extracts are taken from it, a few slight corrections having been made: —

BENJAMIN PEIRCE was the third of the four children of Benjamin Peirce and his wife, a sister of the Rev. Dr. Nichols of Portland. The elder Mr. Peirce graduated at Harvard in 1801, receiving the highest honors of his class, and from 1826 to 1831 he was the college librarian: he wrote also the history of the College from 1639 to the beginning of the American Revolution. Mr. Benjamin Peirce the younger graduated from Harvard with George T. Bigelow, W. H. Channing, B. R. Curtis, Oliver Wendell Holmes, and James Freeman Clarke, in the class of 1829. While an undergraduate he was a pupil of Dr. Nathaniel Bowditch, who made the prediction that young Peirce would become one of the leading mathematicians of this century. After having taught two years at Round Hill, Northampton, he was appointed in 1831, at the same time with Dr. A. P. Peabody, tutor in mathematics at Harvard, and ever since has been actively connected with the College. He became University professor of mathematics and natural philosophy in 1833, and was appointed to his present position, Perkins professor of mathematics and astronomy, in 1842. From 1833 to 1846 he issued a series of school-books on geometry, algebra, and "Curves, Functions, and Forces," which have had a lasting effect upon the methods of teaching in this country. The author acted independently in the introduction of infinitesimals into elementary books, and supplanted many traditional methods in mathematics by concise and axiomatic definitions and demonstrations of his own invention. He surpassed other mathematicians particularly in the choice of notation, which enabled his mind to carry its power of abstract reasoning to a higher degree by reducing mental labor. All his writings contain novelties which bear the stamp of a powerful individuality. A curious instance of this is his discovery of a lurking preference in the mind for particular fractions that occur in computation, and his adoption of a means of avoiding the error naturally resulting from such preference. Another remarkable instance of

his acute perception is his criterion for rejecting discordant observations. Here, too, he found the mind was liable to be influenced by an unconscious preference, and so made his selection from the several observations by a new application of the mathematical law of probability. . . .

In 1852 were printed Peirce's lunar tables, to be used in making computations for the Nautical Almanac, with which publication Professor Peirce was long connected as consulting astronomer. Though intended to serve only a temporary purpose, till the long-expected tables of Hansen should make their appearance, these tables have ever since been retained in use as giving results quite as accurate as are obtained by the aid of Hansen's computations. From 1852 to 1856 Professor Peirce made a laborious investigation into the nature of Saturn's rings, and demonstrated that they are not solid, but fluid, sustained by the planet's satellites. In 1857 appeared "A System of Analytic Mechanics," consolidating "the latest researches of the great geometers and their most exalted forms of thought," but containing brilliant results of the author's own labor. From 1867 to 1874 he was superintendent of the United-States Coast Survey; and in 1870, with the help of his associates, there was published an edition of one hundred copies of certain papers communicated to the National Academy upon "Linear Associative Algebra." This work is an examination and enlargement of the new mathematical science of quaternions. This science, in which distances and directions are measured, not, as in ordinary algebra, by quantity, but by units of quality as well, was developed by Hamilton in 1852, and is considered a most remarkable achievement. Professor Peirce first explains the nature of qualitative and quantitative algebras, and then shows that there may be a score or more of algebras of distinct qualitative units. Among the important original results of his labor is a determination of the forms of equilibrium for a fluid in an extensible sack in another fluid, and a theory of comets' tails. For the past ten years of his life he published less. He withdrew more and more from active work in the College, leaving his son, Professor James Mills Peirce, to take his place in the class-room, while he gave himself up to the enjoyment of the philosophic and religious beliefs which his lifelong pursuit of science had unfolded and made dear to him. . . .

At the time of the publication of his "System of Analytic Mechanics," Professor Peirce announced that the volume would be followed by three others, entitled respectively, "Celestial Mechanics," "Potential Physics," and "Analytic Morphology." In them would have been expected some reference to theology, but they were never published. In his recent lectures on "Ideal-

ity in Science," however, are embodied many of his views on philosophy and religion; and even in such a purely technical work as the Analytic Mechanics crop out references to spiritual things. He has, says ex-President Hill, "too much intellectual honesty to conceal any of his views." Starting with the idea that force resides in the will, he concludes, through the consciousness of freedom and efficiency in himself, that motion is a manifestation of force; and the conception of force outside of himself leads him to a belief in an all-powerful and conscious will which is the seat of that force. "Every portion of the material universe," writes Professor Peirce, "is pervaded by the same laws of mechanical action which are incorporated into the very constitution of the human mind." The universe, then, was made for the instruction of man. With this belief he approached the study of natural phenomena not in the spirit of a critic, but reverently in the mood of a sympathizing reader; and the lesson he reads is, "There is but one God, and science is the knowledge of Him." . . .

FROM THE BOSTON *EVENING TRANSCRIPT*, OCT. 7.

PROFESSOR PEIRCE was a scientific man who had that noblest and most valuable and productive of gifts, the scientific imagination. Learning did not choke up, but watered, the springs of original thought in him. No surer mark of rare genius can be named. Mathematics were employed by him to clarify the profoundest delvings into the mysteries of mind and the most exalted speculations upon religious beliefs. He could grasp instantly and hold firmly the most general conception of every thing and any thing; and his mind was of that genial, fervid kind, that is open and impressible on all sides, and did open with pleased wonder and curiosity to every thing in nature, art, and society, as well as science. His lectures here last winter on "Ideality in Science" displayed well the highest and noblest characteristics of his mind; and it is pleasant to remember that he saw and knew that they were appreciated. His active service in the University and in his chosen field of science was finished; but the influence of his presence was something that will be missed, and leave a void not to be filled. Long may it be ere the same must be said of the distinguished men of his generation who

with him have made the name and consideration of this literary community of Cambridge and Boston what they are, and whose successors are not yet visible among us!

FROM THE BOSTON *JOURNAL*, OCT. 7.

THE life of a professor generally displays few strange or startling incidents; and the record of Professor Peirce's life must be sought in what he was, rather than in what happened to him. As a mathematician he attained the first rank; and he had few, if any, companions in his highest intellectual labors. He was noted for his directness and conciseness of demonstration, and by the intuitive insight with which he approached the most difficult problems. When engaged upon any difficult question his entire energies were bent upon it, so that, although he had brought forward works nearly to the time of publication, he would be so far led away into other regions of thought that he found it difficult and irksome to return. Thus it was that his published works are few; although his contributions to the science of mathematics are most important, and his text-books and elementary treatises are widely circulated. . . . To Professor Peirce belongs the distinction of being one of the founders of a new branch of mathematics, the final form of which is not yet determined, but which may prove to be the great event in the mathematical history of this century. The contributions to this branch have been made by Sir W. Rowan Hamilton in his "Quaternions," H. Grassmann, in his "*Ausdehnungslehre*," and Professor Peirce in his "Linear Associative Algebra." This work has been published in an edition of some one hundred copies, which was not put in type, but lithographed from the manuscript. As an astronomer Professor Peirce's record is high, although he has written no work on the science.

FROM THE NEW-YORK *TRIBUNE*, OCT. 7.

PROFESSOR PEIRCE was the son of Benjamin Peirce, the librarian of Harvard University from 1826 to 1831, the year of his death. Benjamin Peirce, sen., was the first scholar in the class of 1801, and for some years was a merchant at Salem, Mass. After his appointment as librarian, he wrote a partial history of the University, bringing it down to the time of the Revolution: this work was published in 1833. Benjamin Peirce, jun., was born at Salem, April 4, 1809, and was prepared for college under the instruction of Nathaniel Bowditch and at Andover. He entered Harvard in 1825, and immediately distinguished himself by his devotion to mathematics. He was graduated in 1829, and at once took a position as a teacher of mathematics in Round Hill School at Northampton, Mass., then under the charge of Joseph G. Cogswell and George Bancroft.

In 1831 Professor Peirce returned to Cambridge to fill the position of tutor in mathematics in the University. In 1833 he was made University professor of mathematics and natural philosophy, and in 1842 he became Perkins professor of astronomy and mathematics. In 1867 Professor Peirce was made Superintendent of the United-States Coast Survey, and held the position for seven years. Since 1849 he had been consulting astronomer to the *American Ephemeris and Nautical Almanac*, and for many years he directed the theoretical part of the work. In 1855 Professor Peirce was one of the men intrusted with the organization of the Dudley Observatory. For many years before and after he took charge of the Coast Survey, he was consulted frequently in the work of the office. . . . He received the degree of LL.D. from the University of North Carolina in 1847, and from Harvard University in 1867. He was elected an Associate of the Royal Astronomical Society of London in 1849, and a member of the Royal Society of London in 1852. He was elected president of the American Association for the Advancement of Science in 1853 (the fifth year of its existence), and was one of the original members of the National Academy of Sciences. He was a member of the Royal Societies of Edinburgh and Göttingen, and Honorary Fellow of the Imperial University of St. Vladimir at Kiev. . . . Professor Peirce was married in July, 1833. His wife, three sons, and a daughter survive him. His eldest son, James M. Peirce, is University professor of mathematics in Harvard; Charles S. Peirce is a professor in the Johns Hopkins University; H. H. D. Peirce is connected with the firm of Herter Brothers, of this city.

FROM THE BOSTON *EVENING TRANSCRIPT.*

HIGH on the list of monumental names
Of sons of science in thy native land,
Thy honored name conspicuous stands inscribed;
Nor shall its capitals grow dim with years.

'Twas fit thy long farewell to earth should come
When autumn shed its withered leaves around.
No wintry chills had closed the dying year;
So *thou*, ere wintry age had chilled thy powers,
Art gathered home to fields of higher growth.

Thy exit here was but thy entrance there,
Where spring perennial blooms upon thy path.
Beside thy couch a guardian stood unseen,
To watch the signal of thy latest breath;
And at its hush he opened wide the door,
Let in the sunlight of immortal day
To beam forever on thy opening eye.

But now what sounds of welcome strike thy ear
From those that meet thee on celestial shores,
Who once on earth the paths of science trod!
There thou now read'st creation's highest truth:
All who have lived live now in endless life.
No dark annihilation's night has checked
The march progressive of those minds like thee,
Who in time past the lamp of learning bore.

Couldst thou now speak to mortal ears once more,
Thy words would tell of sympathetic threads
Leading through time and space that touched thy soul
Upon its entrance to a higher life;
Of words of greeting that fell on thy ear
From those once known to thee, or known by fame,
As thy companions in the search profound
Of Nature's truths in years or centuries gone.
An Agassiz is there to welcome thee,

And thy own Bowditch is not far away;
For who shall say that, ere this present hour,
Thou hast not met in converse face to face
A Newton, Leibnitz, Bacon, a Laplace;
And with them seated on some height sublime,
That overlooks the wide expanse of worlds,
Hast talked of laws of motion yet unknown
In mortal depths of mathematic lore;
And with thy vision that can far outreach
The telescopic gaze with which thy eye
On earth could penetrate the realms of space,
Canst planetary globes behold unseen by man,
And trace the blazing comet as it sweeps
Its mighty circuit of a thousand years?
These were thy hopes expressed when yet on earth,
While bright reality stood beckoning on
With guiding hand, that *now* holds fast thy own.

Around thee no materialistic chain
Thy demonstrative science ever threw
To hold in doubt a life beyond the grave,
And dwarf the infinite to narrow sense,
That claims where nought is seen there nought can be.
Had thy bold genius lacked the potent spring
Coiled by immortal hope's inspiring power,
Unsinewed, thou hadst never climbed so high,
And left thy mark emblazoned to the world.

The planets in their orbits long had moved
By laws that never were revealed to man,
Till minds like thine sought out the hidden key
Which laid them open to the common eye.
Not all the arts of ancient Greece and Rome,
Nor age mediæval's theologic mist,
Could tell that force centrifugal was bent
By force centripetal's well-balanced curve,
To guide earth's motion in its annual round.
Or, if this truth was faintly shadowed forth
By minds heretical in cells obscure,
It found no credence in the schools long sunk
In shades of dark ecclesiastic night.

Hadst thou then lived when Church infallible
Prescribed the bounds to universal truth,
And hadst thou said, "Earth on its axis turns,"
Thou mightst for years in prison walls confined
Have paid the forfeit Galileo paid.

Thy friends in sable robes and bowed with grief,
As to thy lifeless form they bade farewell,
Beheld through tearful eyes the look serene
Stamped by thy parting soul upon that brow
Ere he did turn to wing his upward way.

He who gave life gave what seems death to man,
But 'tis a death that gives more life to life.
Creative force and force destructive joined
Live not as attributes of Power Divine.
God with one hand withdraws the life of earth,
But with the other gives the life of heaven.
Death is a word in language all unknown,
Save in the lexicon compiled by man.

GEORGE THWING.

FROM THE SPRINGFIELD *REPUBLICAN*, OCT. 11.

AT the death of some men and of many women it is proper that the few who knew them best should say to us who survive, what their life-work was, and what the character which shaped it or grew out of it. But when men of a public genius and of known fame pass from earth, and their lives are commemorated by other public persons, there may yet be room for the reminiscences of those who knew them less intimately, but who, from casual association, or the communication of pupil with teacher, may have noted traits that sometimes escape the observation of familiar acquaintance. It is a maxim in one of Professor Peirce's polygon of sciences — astronomy — that the eye sees better in certain star-fields by a side glance than by direct gaze. Let this be the excuse (as respect and affection are the motive) for adding a few words to the tributes that genius and friendship will pay to this man of friendly and soaring genius.

To most young men Peirce, in his own mathematical demesne, was formidable or quite inaccessible, — the warder of an enchanted tower, whose banner bore a strange device (being interpreted, it said *Excelsior*) whose speech was foreign, and who paced his battlements with a far-looking manner, —

"His thoughts commercing with the skies."

But when this wizard stepped down from his post, crossed his moat, and opened his garden gate, nothing could be more attractive than the vistas and plantations he opened to our view. I remember as but yesterday, though it is well-nigh thirty years ago, the blank confusion with which the ill-instructed youth confronted his problems and the Sphinx who gave them out, and the thrill of enthusiasm in the same youth when the range and scope of the mathematical sciences was flashed upon his imagination, in the fascinating lectures, of which he gave us only too few. Few men could suggest more while saying so little, or stimulate so much while communicating next to nothing that was tangible and comprehensible. The young man that would learn the true meaning of *apprehension* as distinct from *comprehension*, should have heard the professor lecture, after reciting to him.

Peirce was a transcendentalist in mathematics, as Agassiz was in zoölogy; and a certain subtile tie of affinity connected these two men, so unlike in their special genius. Looking up to his familiar stars, Peirce might have said to Agassiz, as Persius to Cornutus, —

Nescio quod certe est quod me tibi temperat astrum;
"Some star, alone to heaven known, attuned in tone these souls of ours."

Other professors, genial or learned or wise, or all three in one, like Dr. Walker, adorned in my time the places they held at Cambridge, but Agassiz and Peirce were the men of genius we met there. Alike in this, they were also alike in their enthusiasm, which neither the piercing scepticism of Cambridge could wither, nor declining years chill with the frost of age. Indeed, we have fancied that Peirce grew more enthusiastic as he grew older: those long gray locks were not shaken in reproof of youthful eagerness, like so many bald heads we have known, but the magnificent front they encircled smiled a welcome to all that was new and advancing. The thing he distrusted was routine and fanatical method, whether new or old; for thought, salient, vital, co-operative thought, in novel or in ancient aspects, he had nothing but respect and furtherance. Some recent words of his are both characteristic and instructive. He said: —

"Those who have lived long enough to have observed the growth of

American colleges, and have seen in how short a time the favorite seat of learning can change from place to place . . . have seen flourishing institutions reduced to comparative inefficiency by the loss of great scholars and vigorous investigators of science. It is questionable whether Harvard is not already suffering in this direction, whether there is not too profuse an expenditure upon class-teaching, and whether the outlay to supply the loss of the higher and the more inspiring instruction, which is given by such men as Felton and Agassiz and Wyman and Winlock, is not unfortunately restricted. Enthusiasm, which is the highest element of successful instruction, can best be imparted near the fountain-head, where the springs of knowledge flow purest, and where the waters are undiluted by the weakening influence of text-book literature."

Those who stood near Professor Peirce in these later years know well that he did not share the cool indifference, still less the irreverent aversion to the Father of souls, which has been a growing evil among men of science. He did verily believe in the human soul, and of course in the divine soul; and he saw no reason and had no wish to avoid the consequences of that belief. It was no doubt with this thought in mind, as well as from his admiration for Professor Harris and others concerned in the Concord School of Philosophy, that he welcomed it so cordially and counselled them so wisely respecting it. He alone of the Cambridge professors was consulted in advance concerning it; and perhaps he was the only one among them who could then have foreseen, as he did, its mission and its probable success, or who would have lent his name and voice to the undertaking. For this, and for many evidences of friendly support in causes that appeal but faintly to popular recognition, at least in their early stages, some of us cherish with renewed affection the memory of this public-spirited man.

Of his special work in science, others can better speak, or have already spoken. But it may here be said that he never overvalued his services in this direction: he was willing to be esteemed for less than he had done, and could join most heartily in the praise of others who perhaps owed their impulse to him. Modest and magnanimous, but not unobservant, his ambition for personal distinction was early and easily satisfied; and he thus rid himself of what is to most men of science a perturbing, and too often an ignoble, element of discomfort. America has nothing to regret in his career but that it must now be closed; while her people have much to learn from his long and honorable life.

F. B. S.

Concord, Oct. 7, 1880.

FROM THE *NATION*, NEW YORK, OCT. 14.

THE name of Benjamin Peirce, who died in Cambridge, Oct. 6, has shed lustre upon mathematics and physics in America for many years. Born at Salem, Mass., April 4, 1809, he was graduated from Harvard College at the age of twenty, and two years afterwards was appointed tutor. For forty-nine years he was directly connected with the Faculty of the College. He published a series of text-books on pure mathematics, also a quarto volume on analytical mechanics, and a lithographed volume on linear and associative algebra, besides making numerous contributions to scientific periodicals, the proceedings of learned bodies, and the appendices of the United States Coast Survey Reports. The enthusiastic admiration felt towards him by his intimate friends was due to his moral as well as to his intellectual character. Making the concession that there was occasionally a touch of intolerance in his manner towards pretentious mediocrity, they would allow nothing in him to have been aught else than of the highest quality. Persons who could not understand a word of his abstruse speculations were compelled to listen to his earnest argument, and knew that his conclusions must be important and true, even when they did not know what his conclusions were. Successive classes complained of him that he did not make himself plain to the ordinary understanding, that he was not a good teacher; yet they felt a potent influence from him stimulating them to higher efforts of the mind and to a nobler moral stand.

His published works are remarkable for the novelty or originality, both of their lines of thought and of their methods. He was singularly direct and clear: the only obscurity which is ever found in his writings is that which arises from the omission of the simpler links in the chain of reasoning. But to a well-grounded mathematician this very brevity becomes an efficient source of perspicuity. No fog is more bewildering than verbosity, which never approached Peirce's writings. His mind moved with great rapidity, and it was with difficulty that he brought himself to write out even the briefest record of its excursions. In a mathematical society over which he presided for some years, the contrast between him and the secretary, Professor Winlock, was as noteworthy as the remarkable talent of both. The society comprised half a dozen other men of some reputation in Cambridge and Boston, who met to discuss purely mathematical topics. Each member would bring forth something novel in his own particular branch of inquiry; and in the discussion which followed it would almost invariably appear that Peirce had, while the

paper was being read, pushed out the author's methods to far wider results than the author had dreamed. The same power of extending rapidly in his own mind novel mathematical researches, which ordinary men could have done only by days of labor with paper and pencil, was exhibited at the sessions of every scientific body and every chance meeting of a scientific character at which he was present. What was quite as admirable was the way in which he did it, giving the credit of the thought always to the author of the essay under discussion. His pupils thus frequently received credit for what was in reality far beyond their attainment. He robbed himself of fame in two ways: by giving the credit of his discoveries to those who had merely suggested the line of thought, and by neglecting to write out and publish what he had himself thought out.

Professor Peirce's activity of mind was by no means confined to the special topics of physics and mathematics. He was among the first to read any new and noteworthy poem or tale, to hear a new opera or oratorio; and his judgment and criticism upon such matters was keen and original. His interest in religious themes was deep, but it was in the fundamental doctrines rather than in the debates of sectarians: he was a devout believer in Christianity, but held to no established creed. The quickness of his observation of external things was as decided as was his power of abstraction. The plants and insects by the roadside he observed as a naturalist observes them. To his paper, read in 1849, before the American Association for the Advancement of Science, the botanists and zoölogists are indebted for what will, we think, in the future progress of biology prove to be a great intellectual step in physics. He showed in the vegetable world the demonstrable presence of an intellectual plan; that what had been called phyllotaxis involved an algebraic idea: Mr. Chauncey Wright afterward showed that this algebraic idea was the solution of a physical problem. There the matter dropped, but it will not lie neglected forever; and in future discussions the value of this and of sundry other of Peirce's contributions to organic morphology must be acknowledged.

The higher mathematical labors of so eminent a geometer must, of course, lie beyond the course of general recognition. Among the things which give him a just claim to this title may be mentioned his discussion of the motions of two pendulums attached to a horizontal cord; of the motions of a top; of the fluidity and tides of Saturn's ring; of the forms of fluids enclosed in extensible sacs; of the motions of a sling; of the orbits of the comet of 1843, Uranus, and Neptune; of the criteria for rejecting doubtful observations;

of a new form of binary arithmetic; of systems of linear and associative algebra; of Espy's theory of storms; of various mechanical games, puzzles, etc.; of various problems in geodesy; of the lunar tables, and occultations of the Pleiades, etc., etc. When in 1846 he announced in the American Academy that Galle's discovery of Neptune in the place predicted by Le Verrier was a happy accident, the President, Edward Everett, "hoped the announcement would not be made public: nothing could be more improbable than such a coincidence." — "Yes," replied Peirce, "but it would be still more strange if there were an error in my calculations," — a confident assertion which the lapse of time has vindicated. None of his labors, perhaps, lie farther above the ordinary reach of thought than his little lithographed volume on Linear and Associative Algebra. In this he discusses the nature of mathematical methods, and the characteristics which are necessary to give novelty and unity to a calculus. Then he passes to a description of seventy or eighty different kinds of simple calculus. Almost no comment is given; but the mathematical reader discovers, as he proceeds, that only three species of calculus, having each a unity in itself, have been hitherto used to any great extent, — namely, ordinary algebra, differentials or fluxions, and quaternions. Whether the clinant algebra of Ellis would stand Peirce's tests, we have not examined. But what a wonderful volume of prophecy that is which describes seventy or eighty species of algebra, any one of which would require generation after generation of ordinary mathematicians to develop! Besides his labors as professor at Cambridge, Peirce was always of great assistance in the *American Ephemeris*, and in the Coast Survey, of which he was for a time superintendent. The reports of that Survey and the tables of the *Ephemeris* have rapidly raised the scientific reputation of America, which, in 1843, stood in astronomy among the lowest of civilized nations, and is now among the highest,—a change which was by no means ungrateful to Peirce's strongly patriotic feeling, and which he could not but know was as much due to himself as to any other person.

FROM THE *WOMAN'S JOURNAL*, OCT. 23.

THE death of this chief among American mathematicians should cause an especial feeling of loss on the part of women, inasmuch as he, like his friend

Agassiz, was a life-long advocate of higher education for both sexes. Many years before the "Annex" was ever dreamed of, he formed a class in geometry for girls in Cambridge, of which my own elder sister was a member; and he more than once received young women as pupils in the higher mathematics. He was one of the first and warmest friends of school suffrage for women, attending some of the first and some of the latest meetings on that subject, down to the time of his last illness; and on one of these occasions, last April or thereabouts, at a meeting held in Boston, he made an appeal to women for the discharge of their duty under the law, — an appeal so solemn and impressive as to hold the audience spell-bound. There was always something peculiarly serious in his manner and thrilling in his voice, when he was deeply moved; and I should not think that any person who heard him at that particular time could ever forget it.

Professor Peirce was one of the last links between the old and new Harvard College. He recalled a period when the numerical smallness of the corps of professors was balanced by remarkable individual instances of strength and talent; so that, while the total weight of influence exerted over pupils may have been less than now, the strength of individual impression was perhaps greater. It is the fashion to speak of Professor Peirce as a man of great mathematical genius, but unfitted for a teacher; as one whose books were obscure, and whose personal instructions difficult and discouraging. But, speaking as one of his earlier pupils, I can say that his was on the whole the most stimulating intellectual influence I ever encountered; that no text-books bring back such associations of mental excitement as his Geometry and Algebra and Trigonometry; I never open them without wishing that I could resume that particular study with him as a teacher; and this, after all, must be the test of influence.

Perhaps there was something particularly favorable in the circumstances under which I first knew him. My class in Harvard College was the first in which was tried a short-lived experiment toward what is now called the Elective System. By the plan then attempted, mathematics ceased to be a prescribed study after the sophomore year; and only those continued it who voluntarily chose that elective. This system, now familiar, was then a novelty; and it was probably a real pleasure for a man of genius like Peirce to have in his hands only a few who were willing to be taught, instead of a large number of unwilling pupils to be dragged along. In the first glow, he probably overrated both the zeal and the capacity of his special students; but he certainly threw himself with the greatest zest into the work of instruction.

He gave us his "Curves and Functions" in the form of lectures; and sometimes, even while stating his propositions, he would be seized with some mathematical inspiration, would forget pupils, notes, every thing, and would rapidly dash off equation after equation, following them out with smaller and smaller chalk-marks into the remote corners of the blackboard, forsaking his delightful task only when there was literally no more space to be covered, and coming back with a sigh to his actual students. There was a great fascination about these interruptions: we were present, as it seemed, at mathematics in the making; it was like peeping into a necromancer's cell, and seeing him at work; or as if our teacher were one of the old Arabian algebraists recalled to life. The less we knew of what was going on, the more attractive was the enthusiasm of the man; and his fine face and impressive presence added to the charm.

The real fame of Professor Peirce will of course rest on those great mathematical discoveries and suggestions, which, in the opinion of those best qualified to judge, will gradually exert a marked influence on the science of the future. As to this it would be presumption in me to express an opinion; but, having had the good fortune to be included under very favorable circumstances among his pupils, I can testify most cordially as to the strong influence he exerted on at least one of that number. T. W. H.

FROM THE *AMERICAN JOURNAL OF SCIENCE* FOR NOVEMBER.

PROFESSOR BENJAMIN PEIRCE, LL.D., F.R.S., Perkins professor of astronomy and mathematics at Harvard University, died at his home in Cambridge, Oct. 6, in the seventy-second year of his age, and the fiftieth of his connection with the University. His father and mother were both distinguished for their acuteness of mind; and his instructor, Nathaniel Bowditch, predicted that the boy Peirce would be one of the first mathematicians of his day, — a prediction fully realized. In 1831, two years after graduation at Harvard College, he was appointed mathematical tutor, in 1833 professor, and in 1842 he was appointed to the chair he filled and honored until his death. He found it consistent with his devotion to science to do much work in connection with other institutions than Harvard during his professorship.

Among these services, in 1849 he undertook the revision of the *American Ephemeris and Nautical Almanac*, for which he prepared his valuable lunar tables. In 1855 he was one of the commission to organize the Dudley Observatory. From 1867 to 1874 he was in charge of the United-States Coast-Survey, and rendered great service to the country and to science by recruiting the languishing financial strength of that service, and impressing upon Congress the duty of effectually re-organizing and pushing forward the work so much retarded by the civil war. He was one of the original members of the National Academy. He threw all his influence into the organization and successful development of the American Association, which he always held should be free from class distinctions, and to which he would never be elected in the higher class of fellows, but was a member only. He contributed very largely to make the American Academy of Boston what it is; and throughout the whole of the scientific literature of the past fifty years Peirce's name frequently occurs as a contributor upon mathematical and physical topics. In his own department of the University he thoroughly impressed the concise methods of thought so effectually used in his greater works. The teaching at Harvard is based upon his methods and notation, and these methods are models of perspicuity and elegance. In physical astronomy perhaps his greatest works were in connection with the planetary theory, his analysis of the Saturnian system, his researches regarding the lunar theory, and the profound criticism of the discovery of Neptune following the investigations of Adams and of Leverrier. As a mathematician, his work on Analytical Mechanics, his treatise on Curves, Functions, and Forces, and his memoir on Linear Associative Algebra, all evince extraordinary originality and genius. Many of his detached papers, relating to the theory of observing, and the solution of special problems, show an appreciation of the needs in applied mathematics which perhaps has not been exhibited by the same order of genius since the death of his friend and admirer, Gauss. His originality was fostered by his habit of examining a new mathematical question for himself, and only referring to the work of other geometers after he had first fairly exerted his own powers of analysis.

His genius was early recognized abroad; and elections to the Royal Societies of London, Edinburgh, and Göttingen, and to various Continental societies, were awarded him. The versatility and breadth of his mind is partly shown by the scope of his papers; but to those who came in daily contact with him he showed such a penetrating discernment of the conditions of a problem, he made such sagacious suggestions regarding the inferences to be drawn

from the data before him, he showed such a wonderful power of generalization, that the papers he has given to the world only seem to indicate the quality of work his mind had constantly before it, and to afford no idea of the multitudinous problems he had been interested in, and discarded as soon as the solution became evident to himself. He habitually ascribed to his listener a power of assimilation which the listener rarely possessed. He assumed his readers could follow wherever he led; and this made his lectures hard to follow, his books brief, difficult, and comprehensive, and his best work only when his listeners were students trained in his methods who had already attained some skill as mathematicians. He was personally magnetic in his presence. His pupils loved and revered him, and to the young man he always lent a helping hand in science. He inspired in them a love of truth for its own sake. His own faith in Christianity had the simplicity of a child's; and whatever radiance could emanate from a character which combined the greatest intellectual attainment with the highest moral worth, that radiance cast its light upon those who were in his presence. His works are already scarce, and some of them hardly obtainable; notably the second volume of his "Curves, Functions, and Forces," and his memoir on "Linear Associative Algebra." It is much to be desired that the manuscripts he has left be completed so far as possible, and made accessible; and this work could devolve on no person so well qualified as is his distinguished son, Professor James Mills Peirce. L. W.

FROM *NATURE* FOR OCT. 28.

We regret to have to record the death at Cambridge, Mass., on Oct. 6, of Professor Peirce of Harvard University. . . . For the past thirty-five years he has occupied a professorship at Harvard; and as a lecturer, author, thinker, and investigator, has ranked not only among the first of a numerous corps of professors, but also among the first of American men of science. Devoting himself originally to mathematics, Professor Peirce has successively pursued exhaustive studies in all the branches more closely allied to mathematics, and has attained eminence equally in physics, astronomy, mechanics, and navigation. His numerous investigations in these various departments, while read before various scientific societies, have been published, unfortu-

nately, for the most part in the briefest possible form, and the results of many of his researches are to be found only in the manuals he published. As an author Professor Peirce was highly esteemed upon both sides of the Atlantic; his work on analytical mechanics, which appeared in 1857, being regarded then, even in Germany, as the best of its kind. . . . As a lecturer Professor Peirce was highly esteemed in both scientific and popular circles. It is related that in 1843, by a series of popular lectures on astronomy, he so excited the public interest that the necessary funds were supplied for erecting an observatory at Harvard. A remarkable series of lectures on "Ideality in Science," delivered by him in 1879 before the Lowell Institute in Boston, attracted the general attention of American thinkers, on account of the thoughtful consideration of the vexed question of science and religion.

Much of Professor Peirce's activity was absorbed by his duties as the head of the American Coast Survey, a position in which he succeeded Professor Bache. He brought to this work the same degree of zeal and ability which were so brilliantly evidenced by his predecessor, and constantly maintained the well-earned reputation of the Coast Survey among the hydrographic efforts of our day. Professor Peirce was one of the founders of the American National Academy of Sciences. In 1853 he presided over the American Association for the Advancement of Science. . . .

FROM THE *JOURNAL OF SOCIAL SCIENCE*, No. XII.

. . . He was not one of the original members of the American Social Science Association when organized in 1865, but he joined it in 1868 or early in 1869, and for three years gave great attention to the Department of Education, of which he was chairman from 1869 to 1872. At the time, in 1872–73, when the practical discontinuance of the Association was favored by many members, by reason of the difficulties attending its work, Professor Peirce was one of those who most earnestly urged its continuance; and it was mainly owing to his remarks and those of Professor Agassiz, at one or two public meetings in Boston, that the Association remained in activity during the years of panic and political change that followed in the re-election of Gen. Grant in 1872. He supported the course taken by the Association in 1874, in favor of "honest money," and in that year, for the first time, read a

paper at our General Meeting in New York. He took an active part in the interesting General Meetings held at Detroit in 1875, at Saratoga in 1876–77, and finally at Cincinnati in 1878, on which occasion he presided, and made the address here printed. He also joined in the debates, particularly of the educational section, and was foremost in all the work of that year.

Toward the end of 1878 he brought forward in the Council a comprehensive plan for connecting our Association with a great university, — a plan for which the time was not then ripe, but which is likely, in some form, to be adopted hereafter, and to add materially to the opportunities of university culture in America. This was a subject on which he thought and felt profoundly, and which also much occupied the mind of Agassiz in his later years. The discussions of our Department of Education in 1869-70 show how the organization of American universities was viewed by these two men of genius and of wide observation. . . . Professor Peirce's conception of the American Social Science Association was this, — that it should be a *university for the people*, — combining those who can contribute any thing original in social science into a temporary academical senate, to meet for some weeks in a given place and debate questions with each other, as well as to give out information for the public. In this line of thought he favored, also, the establishment of the Concord School of Philosophy, to do a similar work in the speculative studies; and he lived to see the partial realization of what he foresaw in this instance. He was ready at all times, while strength lasted, to co-operate in such enterprises for the intellectual and spiritual good of mankind; and this Association owes him much for such cordial co-operation and for wise counsel most modestly given. He declined to hold the titular office of President, which was tendered him in 1878, but performed its duties at that time, as he had before performed all the humbler duties assigned him. How nobly he thought of our work, his Cincinnati Address will fully show. May this Association deserve and inherit what he has predicted for its future!

F. B. S.

Βίος δ'ἐς ἀεὶ φθιμένοισιν κτῆμα.

PEIRCE! who wast ever in our minds
As one we wholly loved,
My soul in this a solace finds,
Since thine hath been removed,

That every night, from out the stars
Two large dark eyes I see,
Looking (as 'twere through golden bars)
All tenderness on me:

And we believe, as thou didst teach,
That past the outer lights,
Which once by numbers thou couldst reach,
Thy mind hath gained the heights

Where love, by knowledge more complete,
Shall not withhold from us
Thine old affection's constant heat,
Making ours deathless thus.

T. W. PARSONS.

Christmas-tide, 1880.

ADDRESS.[1]

BY THE REV. JAMES FREEMAN CLARKE, D.D.

It is seldom that a man goes away, whose place is not soon and easily filled. He may be a little wiser, a little better, a little stronger than others; but others come so near him in his special function that they soon replace him. Only occasionally can we use the poet's words, and say, —

> "*Nec viget quicquam simile aut secundum.*" —
> "No one like him, no one near him."

But we must say so now. Our friend, who has left us, filled a place no one else can occupy. In that department of intelligence in which alone man seems emancipated from human liability to error, — in which, with sure foot, he can advance step by step, along the path of the creative mind, — our brother stood among us alone. In this sphere he was able to speak as one having authority; and who was there who could question or criticise? What a singular and strange gift was this mighty function of his intellect! It was born with him. He seemed able, from the very first, to read, with easy facility, the problems of mathematics which others could only solve with labor. As a classmate I remember that our teacher in mathematics, the good and strong man who has just preceded him, — George Ripley, — never ventured in the recitation room to do more than ask one question of Peirce; and then allow him to demonstrate in his own way, as he pleased. It is not for me, however, to speak of his accomplishment and attainment on this great line of thought. I leave the task to others, who will tell us how he has explored these regions of mystery alone, and has gone sounding along the dim and perilous ways untrodden before; how he has furnished new methods of discovery for those who shall follow him, and stated some results which thus far no critic has yet seemed able either to accept or to deny. But that which I most feel now, as I stand here with you to say our brief farewell to this noble friend and brother, is, that, on these cold peaks of primeval thought, where he stood alone with the eternal Laws of Nature, he saw no blind

[1] Spoken at the funeral in Appleton Chapel, Saturday afternoon, Oct. 9.

forces, no dead laws, but always spirit and life. His head was never divorced from his heart. While studying physical facts and methods, he was led, not toward materialism, but toward idealism. The more he became familiar with Nature, the more he looked through Nature up to the God of Nature. His intelligence was so large that it did not need to drop the spiritual side of the universe, in its contemplation of the material order of things, but was able to hold both, at the same time, in its ample grasp. One-sided science and one-sided religion may be hostile, but in his soul these two were one. He saw God in Nature, as in history and in life. His religion was rational, and his science was religious. What a happy life has his been! You, his fellow-workers during long years, in this University, who have seen his manner of living; you, his companions in science, who have taken sweet counsel with him on those high themes, and walked in company with him to that House of God which men call Nature; we, his friends of many years, classmates, brothers, — none of us to-day, can shed bitter tears for him who

> — "Having run
> The round of man's appointed years, at last,
> Life's blessings all enjoyed, life's labors done,
> Serenely to his quiet rest has passed."

We are never nearer immortality than in the presence of such a death as this. We do not feel, we cannot imagine, this to be the end. That marvellous power which holds suns and atoms equally in its grasp; that creative exuberance which is yet so conservative that it gathers up every fragment so that nothing be lost, — this power cannot allow the personal soul, which he has brought up to such a height of development, to be dissipated anew into emptiness. The mind which has been led by God so far, cannot stop abruptly here. If no little bird, on its rocking nest among the boughs, is forgotten by God, we may trust ourselves and those we love to that providence which holds us all in the hollow of its hand. It were almost an absurdity in creation, for such carefully developed souls, the ripe fruit of long ages of preparation, to come to an end with the decay of their earthly organization. The Creator has hung an impenetrable veil between this world and the next, shutting us out from precise knowledge of the great beyond, and so confining us to what we can know and do here. If we saw more of the future, perhaps we should tire too soon of the present. But some things we may believe. Since the Father sends death to all his children, just as he sends them life; as he sends death to the wise and weak, to the saint and the criminal, to the believer and

the atheist, — death must be good ; for what God gives to *all* is a blessing. It must be a good thing to die when death comes. And since the unexhausted powers in man are thought, love, and action ; since there is so much more to know, to love, and to do, than we can accomplish here, — we may believe, that, in the future life, our heaven will be, as our heaven is here, in having plenty to know, plenty to love, and plenty to do. How much work here is just begun, and then dropped ! How the tenderest love of this life seems cold and weak to that of which the human heart is capable ! What vast problems of thought open before our eyes, insoluble by our present methods ! The best things we have or do in this world are only prophecies of what is waiting for us hereafter. We open our arms so wide, and we embrace so little ! We are like children to whom the mother says, " Be patient, little ones : there is time enough ; you shall have it all by and by." Go up, then, dear friend, and go on ! Outsoaring the shadow of our night, advancing into regions of knowledge to which all former insight is but the auroral presage of coming day, go on, to see what you foresaw ! Go up into larger ranges of vision, into a mightier fulness of comprehension. The soul that always humbled itself here in adoration of the first Fair, sole True, will be exalted into communion with the intellectual principalities and powers above. There, too, you will, we trust, meet again the noble brothers of science who have gone before, — those who also believed at once in law and love, in things seen and things unseen, in the God of Nature and the God of Reason and the God of Spirit. There you will meet with Agassiz and Jeffries Wyman, Henry and Bache, and renew on a higher plane the studies and affections of earth. Farewell, brother, for a little time. We who remain will endeavor to use these golden hours of time with something of your fidelity : we also will do the work of Him who sent us while it is day. We will go back to life, not sadly, but grateful to Him who has given us such noble friendships, has enabled us to be the witness of such great labors, and who feeds the heart with such immortal hopes.

SERMON.[1]

BY THE REV. A. P. PEABODY, D.D., LL.D.

"I give unto them eternal life; and they shall never perish." — JOHN x. 28.

As most of you well know, I am among those who attach to declarations like this from our Saviour infallible authority, and who believe that his promise of eternal life was sealed and confirmed by his own resurrection from the dead. But did I not thus believe, I still should derive from him my strongest argument for immortality. If he bore no specially divine commission for mankind, if he simply took and holds, like any other man, the place due to his ability and character, I still must recognize him, the world tacitly recognizes him, as the greatest of men, — the greatest both intellectually and morally, and especially so, in that in him, mind and heart, the intellect and the spirit, were unified as we know not of their having been in any one beside. He knew human nature so well, that while all moral and spiritual teaching not of his school has had but a brief currency, the world has been constantly growing into the appreciation of his teaching in the precise proportion in which it has advanced in intelligence and culture. At the same time, in strength and in beauty, in purity and in love, in those virtues that give might and glory to manhood, in the gentler graces that enrich and adorn quiet scenes and uneventful life, we know not his peer. No other character presents an aspect equally blameless and lovely in every view, to all conditions of men, and in all time.

Such a spirit as his cannot but have the clearest spiritual insight. He convinces me by my conversance with him that he knows more about the realm of spiritual being than any one else who ever trod the earth, that he beheld God, entered into the Divine mind, drank in truth from its living and eternal fountain, as no other human being ever did; and what he says, with entire assurance, with regard to God and man, commends itself to my implicit reception. What he professes to know I must believe. What I of myself dimly see and faintly hope looks clear and certain, if it has his attes-

[1] Delivered in Appleton Chapel, Sunday morning, Oct. 10.

tation. In the spiritual realm, I am still a stranger in many of its provinces, though I hope to be more than a sojourner; but when I enter into communion with him, I feel that I have joined myself to a citizen of that country, who has explored the whole of it, and on whose accounts of it I can place full reliance. Now, he always speaks of immortality as if it were with him a matter, not of doubt or conjecture, not of mere hope, but of certainty.

Nor does it seem to me of small interest for us, that in general it has been the strong and good who have had this assurance; while, of those who have denied human immortality as a baseless vision of fanaticism, no mean proportion have been men who not unfitly might have felt that they had souls not worth preserving. Not that I would cast reproach on honest scepticism, least of all on that not infrequent type which dares not believe so great a blessedness; but it certainly has seldom been among spiritually minded men, or among those of pure and high morality, — that is, among the kind of men that have been the most at home in the spiritual world, — that human immortality has reckoned its foremost deniers.

But not only do I congratulate myself on the testimony of great and good men in harmony with that of Jesus Christ, — it is when I think of such men that real death seems utterly opposed to nature, and in itself incredible. Had not Jesus re-appeared, think you that John and Martha and Mary could have believed him wholly dead? Had the great stone never been rolled away from the sepulchre, would not the saintly women who went thither have felt that the life so divinely pure, so radiantly beautiful, had sunk from their sight, only to rise in some other chamber of that Father's house of which he had been talking so familiarly only three nights before?

But without dwelling on him, the All Perfect, have we not a like feeling with reference to all persons of advanced wisdom and worth? In our own thought we cannot make them dead. They will not stay dead. Press down as you will the earth-clods over what bore their names, you cannot feel that they are buried there, — that all that there was of them is mouldering and crumbling away under the ground.

We talk of a finished life, a life beautifully rounded off, one that has reached its natural period, and is harvested in its late autumn like a shock of corn in its season. There are no such lives; or, if there be any, they are the kind of lives of which such things are never said. The only finished lives are those that are never fairly begun. The only symmetrically rounded lives are those that have described very small circles. The saint, the sage, the genius, though he live to fourscore, feels that his life has been only a begin-

ning to live, and feels so the more profoundly, the farther he advances in wisdom and goodness. The more resplendently he reflects the Divine image, the more transcendently glorious, beyond his present attainment, seems to him the supreme Archetype of goodness. The deeper his search into the works and providence of God, the more vast is the realm of the unexplored; for each new province that becomes known to him abuts on every side upon provinces unknown or but dimly seen. Curiosity, longing, yearning, craving for more of love and of goodness, for more of truth and of light, grows by what it feeds on, and is never more intense and active than almost or quite on the brink of the grave, sometimes in the very last moments making the hope of immortality a prophetic vision of a broader, higher scope for the cognitive and active powers; while if there be a brief suspension as the body lingers and languishes under the death-shadow, it is no longer or more entire than may have intervened in the infirmities or illnesses of earlier days.

The broken column was, you know, the old heathen symbol of a life cut down on its midway career. If there be a reality in death, the symbol is still more appropriate to the lengthened earthly life that has been consecrated to truth and duty. But, blessed be God, the column is not broken. What seems the line of fracture is but the jagged lower outline of a cloud which the keen vision of faith can pierce, and trace the column as it rises and rises, stage upon stage, into the upper heavens among the piliars on which rests the throne of the Eternal. Oh! never seems death so utterly unreal as when it hides from mortal sight the greatly good, the excellently great. I am sure that to them, so far as they retain self-consciousness under the death-shadow, it is but a fleeting shadow; and if for a little while it rests densely on sense and soul, how transcendently glorious the moment when it is lifted from them, and they awake in the everlasting light!

Such are the thoughts which must have filled many minds and hearts, as we looked on that serenely beautiful countenance over which yesterday we here offered our prayers and thanksgivings.

Professor Peirce, passing from us in the fiftieth year of his official connection with our University, had a longer term of service than any member of the academic corps from the foundation of the College, with the one exception of the venerable Tutor Flynt. There was no faint prophecy of his eminence in the families from which he sprang. His father had graduated with the first honors of his class, and in his latter years was well known here as of no less rich endowments of mind than surpassing moral worth. His

mother belonged in intellect no less than by birth to a family distinguished for ability and attainments, and was the sister of the eminent divine, Rev. Dr. Nichols, who was second to no man of his time in vigorous thought, lofty ideality, and kindling fervor of utterance, and who possessed, too, a rare capacity and love for mathematical study and investigation. Our Professor, by common consent unsurpassed in his chosen department, has not transcended the expectation concerning him in his college days, when his fellow-townsman and friend, the venerable Bowditch, foretold of the boy that he would be the first mathematician of his age. His fellow-teachers here had distinct prescience of what he would become, when his tutorship began. While he already took longer steps in the class-room than permitted laggards to keep pace with him, his enthusiasm inspired scholars of the higher order, and made studies that had before been a weary necessity a privilege and a joy. His earliest text-books, unequalled in their kind, marked an era in his department, substituting rigid mathematical processes for easier, but looser methods, which levied on the mind a lighter tax, but gave in return a much scantier revenue. In the second year of his tutorship the absence of Professor Farrar left him at the head of his department, of which he held the direction till he could resign it, with the prestige of his name so worthily maintained, to his son, of kindred taste and capacity.

His work and his fame, before and since, have been world-wide. The introductory volume of his "Physical and Celestial Mechanics" few have read, because few could read it; but by those few it has been regarded as the most profound and thorough and enterprising work of the century, opening vistas of speculation and research which may give direction and scope for the greatest minds of coming generations. If he did not discover the planet Neptune, he did more, in establishing, with the ultimate acquiescence of the scientific world, a possible alternative solution of the disturbances of Uranus.

At the same time, his practical services in the superintendence of the Coast Survey and in connection with the *Nautical Almanac* have proved that the highest science has its utilities for the working-day world, and can bear its indispensable part in the arts most essential to human safety and well-being; nay, that nothing short of this in thoroughness and accuracy can meet the just demands of an advanced civilization.

Of late years his labors as an instructor have been nominally small, and for very few pupils; but never has he taught so efficiently, or with results so well worthy of the mind and heart and soul which he has put into his work. His students have been inflamed with his fervor, stirred to high ambition by

his earnest appeals to every noble sentiment, and started by him, not on the cold, plodding study of books, but on the vivid, eager pursuit of the eternal truth of God, of which the signs and quantities of mathematics are the symbols. There are in other universities, as in our own, not so much trained as inspired teachers, who owe it to him that they are not hearing schoolboy recitations, but transmitting a living science.

Among the various forms of his activity, emphatic mention should be made of his several courses of lectures open to a larger public here and in Boston. These have been unique; and I doubt whether there has been any living man who could have approached him in the union of close scientific reasoning, bold and universe-sweeping speculation, poetic fancy, vivid ideality, and profound religious faith and reverence. In these lectures he has shown, as he always felt with adoring awe, that the mathematician enters as none else can into the intimate thought of God, sees things precisely as they are seen by the Infinite Mind, holds the scale and compasses with which the Eternal Wisdom built the earth and meted out the heavens.

Indeed, this consciousness has pervaded his whole scientific life. It was active in his early youth, as his co-evals well remember; it has gathered strength with his years; it struck the ever recurring key-note in his latest public utterances. He was a devout, God-fearing man, — a Christian, in the whole aim, tenor, and habit of his life. This, — from early, I might almost say native, feeling, and equally from faithful inquiry and established conviction. He was conversant with the phases of scientific infidelity, and by no means unfamiliar with the historic grounds of scepticism. Nor can I regard it as without profound significance, that a mind second to none in keen intuition, in æsthetic sensibility, in imaginative fervor, and in the capacity of close and cogent reasoning, maintained through life an unshaken belief and trust in the power, providence, and love of God, as beheld in his works, and as incarnate in our Lord and Saviour.

There is no need that I speak here of his pure, upright, faithful life. In this, as in his scientific genius, the youth was "father of the man." We who were conversant with his boyhood have not the slightest remembrance of aught that was not in beautiful harmony with what he has been in these later years, when to know him has been to love, admire, and revere.

He has gone from us, not too soon for him to enter on those larger, loftier fields of vision, whose forecast glories shed a light not of earth on his advancing years, but, were it not that God knows best when to call his children home, we should say, far too soon for us; for, before the brief shadow fell

upon him, he seemed still in the full meridian of his life-day. It has been no rare experience to miss the brightest of a galaxy. But now, our one particular star is quenched. Be it ours to cherish the honored name so redolent of genius and eloquence, of social worth and civic virtue, of Christian faith and piety. And in that nearer circle in which the precious memories of our friend are now so laden with the fresh sorrow of bereavement, may they all be transformed into hopes full of immortality, as they cluster around the home where God in his own good time shall gather the parted family, and where "there shall be no more death"!

SERMON.[1]

BY THE REV. THOMAS HILL, D.D., LL.D.

"The Lord giveth wisdom; out of his mouth cometh knowledge and understanding." — PROV. ii. 6.

THE characteristic of the Hebrew literature is its piety; its recognition of one God, the Creator of the heavens and the earth, from whom alone cometh every good gift, and by whose inspiration alone man has wisdom, strength, and righteousness.

Another marked feature in these ancient writings is the recognition of the true relation of knowledge, wisdom, and righteousness; that they stand in this order; that knowledge is the lowest, it is the foundation on which wisdom builds, while righteousness is the highest; that wisdom has not builded worthy of her name until she has built an altar for daily worship and daily renewal of self-consecration to God's service. In the text we have three words indicating this gradation: the Lord giveth wisdom; out of his mouth cometh knowledge and understanding. The word translated knowledge has precisely that force: it is knowledge gained through experience; that translated understanding signifies knowledge gained by reflection, or insight; and that translated wisdom refers to the hidden power of using knowledge and insight in the guidance of life.

These distinctions are deep and subtle: the wisest philosophers puzzle over them in this nineteenth century after Christ, as they did in the ninth century before Christ, and come to no universal agreement. But, subtle as the distinctions are, they are so deep that no man can refuse to perceive their existence. In these ancient Hebrew writings, they are clearly alluded to, and every humble reader of his Bible has a more or less clear perception of the meaning of the allusions. The doctrine of the text is accepted, with more or less understanding of its import, by every devout Christian.

What is the doctrine? It is that our Maker has endowed us with three principal intellectual powers: First, the power of external perception, — the

[1] Preached in the First Parish Church, Portland, Me., Sunday morning, Oct. 10.

power, that is, of seeing, hearing, feeling, the things about us. By this we gain a knowledge of the sun and stars, the earth and its myriad plants and animals, the boundless space in which it moves, and the endless time in which it pursues its revolutions. Secondly, the power of insight; by which we know what is going on in the depths of our own souls, our modes of knowledge, our states of feeling, the struggles of desire and of will, the existence of a moral law, the evidences of God's being, the reality of our relations to Him. Thirdly, the power of guiding and directing our own thought and action into a voluntary conformity to the moral law, into a voluntary service of God by his children.

These are the three great intellectual gifts of knowledge, understanding, and wisdom, which in the text are said to proceed from the Lord. Each one of the three is capable of a very great, an almost endless, diversity of degrees and of variations, so that different minds are fitted for different offices and functions. This has been observed by both heathen and Christian writers in all ages of the world, and is especially dwelt upon by the Apostle Paul. Every honest and earnest man finds some occupation which is agreeable to him, for which he is fitted, and in which he is useful to his fellow-men. It may be that there is, in some cases, great difficulty in actually getting this occupation; but the rule is generally true that a man recognizes it when found.

And in the midst of these diversities of operations of the Spirit of God, there are some who receive ten talents, some who receive but one. The undisciplined and foolish man may sometimes repine and murmur because he has not received greater gifts: he is envious of another man's genius, and soured by his own failures when he attempts that which is too high for him. The disciplined and wise man will, however, rejoice always in his own lot, knowing that the good Lord who assigned us these various parts has it in his power, and in his heart, to cause all things to work out a compensation and a recompense for every seeming evil. If a man has less ability to increase knowledge, he has usually less capacity also for suffering: great gifts of power increase responsibility, care, and labor. Fidelity to one's own opportunities, faithfulness in one's own duties, trust in the Divine Providence which orders one's own lot, meek acceptance of the offers of salvation made by Jesus to each child of man, — these things bring into the humblest heart the peace of God which passeth understanding.

And the man of smaller gifts will, if he be wise, rejoice and be thankful for the gifts bestowed more abundantly upon the chosen few. Pass by, if you

will, the consideration of Him upon whom the Spirit was poured without measure, and to whom we are under obligations far exceeding all our powers of expression: what Christian soul is there who is not thankful that the saint of eagle wing heard in Patmos those promises of unspeakable tenderness recorded by him for us, — soared unto heaven, and heard the Word which was in the beginning, and which assures to us salvation? Who does not give thanks for the inspiration which made Saul of Tarsus the great apostle to the Gentiles, proclaiming to all ages and to all classes of men the unsearchable riches of Christ? And time would fail me to add to Barnabas's list of ancient worthies the longer list of those who through nearly nineteen centuries of Christendom have through faith wrought righteousness, and kindled saving and sanctifying faith in generation after generation of ordinary believers.

The spirit of the Old Testament and of the New requires also in our gratitude to the Lord, the inspirer of all wisdom, knowledge, and understanding, to remember that he gave all those inspirations by which the arts and sciences, the manufactures and commerce of the world, have grown unto their present condition. The space-penetrating power of a great telescope is not so valuable as the prophetic vision which sees the deep things of God: yet it is of incalculable value; and we may thank God, that, through his inspiration of those who form and combine its lenses, we all become more intelligent and willing worshippers of his immeasurable majesty and power. The creative genius of the great poets and writers of fiction — Milton and Bunyan, Shakspeare and Tennyson — is not so valuable as the terrible power with which Paul lays bare the hideous recesses of a sinful heart, or as the sublime force with which John lifts us up into the bosom in which he lay; and yet thousands of Christian souls thank God also for the "Paradise Regained," and for "The Holy War," for the wonderful historic dramas and tragedies, for the subtly woven threnodies, which have been the vehicles of morality and religion and strength and wisdom to millions of readers. What Christian heart can refuse its tribute of gratitude also to Him who inspired the sweet singers of our Christian Israel, with psalms that vie with those of David, and with strains of music that waft the hearer into the presence of the heavenly choirs? Who can measure the effect on the world, in softening the rude and savage manners of former ages, of those wondrous religious pictures, especially of the holy mother and her matchless child, which even to-day draw pilgrims from this side of the Atlantic to behold them?

But we are sometimes told, and are sometimes for a moment half afraid it

may be true, that the day of religious art, and religious music, and religious literature is over. The star which arose in the East, it is said, has passed to its setting in the West; and now there arises, out of the West, a star brighter than the star of Bethlehem, — the star of science, which is to disenchant us of all our old reverence and faith. It is to reveal to us the unreality of every thing on which faith has built, and make clear to us that this world of sense is the only real world, and that death is the end of all our life; that even our human race is to be swept away into utter nothingness, eternal silence and eternal frost.

It requires but an instant's attention to recognize this as the same strain which has been repeated to us from the left for as many centuries as literature records. It can win attention and belief only by first diverting our attention from understanding and wisdom, and fastening it exclusively on knowledge. It is not the voice of science, but only the voice of unwise scientific men. The great increase of knowledge, the marvellous progress of the physical sciences during the last three-quarters of a century, has fulfilled the saying of the preacher, "He that increaseth knowledge increaseth sorrow." Many men who have attained a large knowledge of the movements of matter in the building of plants and animals, fancy themselves thereby qualified to speak with authority concerning questions of metaphysics and theology; and they utter themselves in these doleful denials of the realities of our Christian faith. At the same time, by their activity in matters of scientific publication, they give to the public the impression that they are leaders in science; and thus their gloomy denials of religious wisdom have the more disheartening effect on the public mind.

The evil will be temporary. The Lord giveth wisdom, and out of his mouth cometh knowledge and understanding. The real leaders in science, the master spirits, to whom all three gifts of intellectual power are vouchsafed in due proportion, and each in large measure, are to-day, as they have been in all past ages, men of faith, of devout and religious spirit, recognizing God as the Creator, finding in all their study of His works that there is not an atom in the universe which does not bear indelible evidences of the wisdom and goodness of the Almighty Power which formed it.

We laid yesterday in the grave the body of one who has long been recognized, both in Europe and America, as a man of extensive learning and of the highest genius. Some of his triumphs in the realm of mathematics and astronomy have been as sublime as those of any man among the living or the dead. His vigorous powers have until within a year past shown no signs

of enfeebling age. Yet Peirce was, like his teacher Bowditch, like his friends Agassiz and Henry, and others who have recently preceded him into the world of greater light, a man of the most devout Christian faith. We may say of him, "he walked with God, and he was not, for God took him." He is not dead, and cannot die. The immortality of fame which his works secure him is but a faint penumbra of that brilliant glory into which his conscious spirit has ascended. God was to him the only reality; this world was always to him God's schoolhouse, furnished with the choicest text-books and apparatus; and he was ever desirous of receiving the Master's approval. The universe, he was accustomed to say, "is a wonderful philosophical combination of ideas, a problem for science to solve. What is science but the partial revelation of the harmony of those ideas, of the harmony and self-consistence of God's thought?" At other times his understanding (in the sense of my text) would speak, and he would say that the universe is a poem, history a drama, for the instruction and uplifting of every reader.

Those of my hearers who enjoyed a personal acquaintance with Peirce's maternal uncle, the former revered and beloved pastor of this parish, Dr. Ichabod Nichols, may understand something of that swelling gratitude too deep for words which struggles within me as I remember how much I have owed during the past forty-one years to the influence of this nephew, partaking as he did in so many of his uncle's noblest qualities.

Alas! that he shared also in some of Dr. Nichols's limitations; notably in this, that neither of them left in legible form enough to show to the next generation the full reasons why, in their own day, they inspired their contemporaries with such unlimited confidence and love.

In Peirce's case, however, enough has been published during his lifetime to secure him a permanent place in the literature of mathematics, astronomy, and geodesy; although not enough to show the exalted character of his imagination, the wonderful power of his eloquence, the burning force of his moral rebukes, the great versatility of his genius, the quickness of his observation, the electric rapidity of his mental operations. The walk of a mathematician of so high an order is peculiarly lonely: he roams among Alpine heights which "vulgar feet have never trod," the paths that are "sacred to thought and God."

It would be impossible to translate into ordinary forms of language, even the results, much more the processes, by which he attains certainty on questions which lie far beyond the reach of all usual methods of reasoning. Peirce has rendered to the pure mathematics, to geometry, to astronomy, to

botany and zöology, to geography and geology, even to logic, metaphysics, and theology, valuable services, some of which must be held in everlasting remembrance. No man would select from among the successors of Descartes, Leibnitz, and Newton, twenty names of those who had shown the greatest genius in pure mathematics, down to the year 1875, without including Peirce. Even the reader who knows nothing of pure mathematics must admire the wonderful genius and the sublime self-knowledge of the man, who, when all the scientific world was rapt in admiration of Leverrier, the creator of invisible astronomy, who had said to Galle, "Point your telescope to such a spot, and you shall see a planet never yet beheld by mortal eye, but revealed to me by the eye of faith guided by mathesis," calmly said, "Leverrier deserves all praise as a mathematician, but Galle's discovery is only a happy accident: Leverrier's planet does not exist, and the planet seen by Galle is an entirely different body." Edward Everett, then president of the Academy, asked Peirce to withhold his remark from publication, saying that no words could express the improbability of his statement. "But," replied Peirce, "it is still more improbable that there can be an error in my calculations." Time has long since demonstrated that our American geometer was right.

A few weeks after this great mathematical triumph I met, in State Street, Boston, the historian Jared Sparks, and he remarked to me that he considered Leverrier's calculation, and Galle's discovery, among the most important events in all recorded history. The effect, said he, upon the general human mind, will be enormous, in the confidence which it will produce, the impulse which it will give to every department of science. Wonderfully has this prediction of President Sparks been fulfilled!

A yet more remarkable prediction by Peirce still remains unfulfilled, and ages may pass before even its partial accomplishment. About ten years ago some papers of his were published by the generosity of a few of his friends and pupils. They contained an investigation of sixty or seventy kinds of mathematical language, that is, of sixty or seventy kinds of algebra, a dozen or more of which were very simple. All these kinds were discovered by him in his endeavor to answer the question, What conditions must be fulfilled by any algebra? In solving this question he confined himself under some restrictions, so as to narrow the field, and even then found the multitude of algebras, that is, of mathematical languages, which I have mentioned. Of these, only three had ever been used by mathematicians; those three had given employment to men of genius for centuries; those three had led to all the marvellous triumphs of the science of this nineteenth century; the others

must be considered as prophecies of the methods which may, in coming centuries, be used in the investigation of physical truth.

Nature, says Emerson, never becomes a toy to a wise spirit. In the works of God are hidden unfathomable depths of wisdom and knowledge. And it was Peirce's faith, that whatever mathematical truth men reach by *a priori* reasoning, by researches such as these wonderful ones of his, will, at some future day, in this life, or in that higher life into which he has entered, be found to have been foreknown and used by that Divine Architect who inspires the mathematician as he does the poet and the prophet. Peirce believed, with all his heart, that in consecrating himself to science he was consecrating himself to God. God's service was his highest aim. When in my younger days he judged too favorably of his pupil's mathematical and scientific ability, he wanted me to enter the field of astronomy. But "the yoke of conscience masterful" drove me into the pulpit; and it was a great happiness to me afterward to have him indorse my decision, and earnestly wish me success in my calling. None of you can be more keenly and painfully aware than I am myself of my defects and failures, both as a pastor and preacher; but none of you can know, as I know, how much of whatever benefit or satisfaction you may have received from my ministrations has been due, under the Divine Providence, to the cordial way in which Peirce rejoiced over my entrance upon the field of his revered and beloved uncle's labors. His sympathy and approval, his agreement with me in religious opinions, has been strength and inspiration to me from the day of my ordination, nearly thirty-five years ago, to the present hour. Pardon me, therefore, that I thus speak out of a full heart concerning a friend whom the Lord had gifted so richly with knowledge, with understanding, and with religious wisdom. He was not simply a mathematician: he was a man interested in almost every thing of human interest; reading the literature of the past and of the present with appreciative but discriminating eye. If perchance his judgment differed from that of the public, it was nevertheless sustained by good reasons. For example, among the classic works of the English writers Milton and Bunyan, he always preferred the "Paradise Regained" to the "Paradise Lost," "The Holy War" to the "Pilgrim's Progress," as having much more satisfactory unity in themselves, and thus being more truly works of art; and also, as being much more thoroughly imbued with the genuine spirit and temper of the Master of the Christian Church. This was what chiefly interested him and warmed his heart. He had no interest in the technical discussions of theology; the minutiæ of Scriptural

criticism were dry to him. But his heart was moved by the grandeur of the first chapter of Genesis, his conscience responded to the second and third chapters, his moral judgment pronounced a reverent amen to the Ten Commandments, and his whole spiritual nature rejoiced in the Sermon on the Mount. He thought that the Lord's Prayer carried in itself the evidence of its divine origin; he bowed with reverent and rejoicing faith at the foot of the Cross; and declared that in the very construction of the human heart, the dread sacrifice on Calvary was prefigured and required. Science had not, in his view, completed her task until she had led man to God; knowledge must be followed by insight, and insight by that religious wisdom which will infallibly show the divine beauty of Jesus and the necessity of his messages of reconciling mercy; sin was the one great sorrow of the universe, and Christ the only adequate Consoler.

May our meditations upon the example of this disciple lead each of us, also, to the Master in whose promises he humbly trusted and found rest!

SERMON.[1]

BY THE REV. C. A. BARTOL, D.D.

"He telleth the number of the stars; he calleth them all by their names."—Ps. cxlvii. 4.

WHILE we resume in various ways, how Nature, one after another, resumes us! Several funerals have lately called my attention: first, that of the Norse minstrel, at seventy still a child, a rare nature in the volume of being, as grammarians say of certain expressions in the Bible that they are spoken but once; next, of a four-months' babe, ripening and falling from the tree of life like those blossoms that bring forth fruit on the boughs, and bearing the honored name of that great lawyer and Christian patriot Charles Greeley Loring, dying in the same room, on the same day and almost the same hour of the calendar, thirteen years after his grandfather, as though he had by him been called; lastly, that of the astronomer and mathematician whose demise will produce a sensation in scientific circles throughout the world, as all the pines in the wood resound when some monarch of the forest falls. Death is called in the book of Job "disorderly," because its order is too deep for us to trace. But Nature is impartial, and lays no stress on the decease of king, president, or pope. She loves the babe as much as she does them. Goethe represents her as saying of Shakspeare, "He is a tid-bit; I will take him last," his literary fame being co-eval with the scriptures of Judæa or Greece; but by the wavering leaf of infancy, or crashing oak that may figure transcendent genius or virtue, Nature is alike unmoved. The storm that rattled the windows of the houses at Cromwell's departure, and the veil rent and darkened land when Jesus expired, were only seized upon by friends as signifying the importance of these men, great in different spheres. *We* emphasize, but Nature writes nothing in italics: she holds on her even way. The termination of the humblest career tears some heart-string; and, when some highly honored personage disappears, we try with our words to blow the trumpet of his fame; but as we leave the loud platform or solemn desk, and come out into the air, the open sky with its vast

[1] Preached in the West Church, Boston, Sunday morning, Oct. 17.

inverted cup has no word, only a smile, for all our gesture and speech. Yet when I see the beauty of this border and fringe of the universe, the leaves at this season turning to crimson, coral, and yellow gold ere they drop, let no sceptic tell me it is superstition to believe that a Higher than we causes and delights in these charms, and angels innumerable and unseen give us in our transport a share of their ecstasy.

You will understand it is the religious character of Benjamin Peirce, — the great professor, — of whom I am to speak, that prompts such reflections for the fit preface and tenor of any true history of his course. His merits in that field of calculation so few are able to enter, among the stars, being unable to measure, I must leave to a jury of his peers, among whom he stood in the first rank, at Paris and Berlin as well as Washington and as well as Boston. What in him fixes my thought, and concerns us all, is his moral example, and his contribution in his convictions to Christian faith.

"An undevout astronomer is mad."

But how few ministers and communicants in regular standing were as devout as he! He belonged to the same class of minds with Newton, Kepler, Swedenborg, Plato, and all philosophers of supreme influence and repute, in whom keen perception and worshipful feeling are combined. The students of phenomena, of the symptoms in the creation or any of its parts, may be atheistic, as physicians and physical observers have sometimes been; but Professor Peirce was one of those who take the spiritual into their view. He was a second-sighted, double-sighted, or binocular man. His observation never stuck in the material facts, or stopped short of the principle. If he did not conceive of laws as given or made at any period of time, he beheld them inhering in an Infinite One, eternal and alive, whom he could love and adore. Therefore I single out and point to this dear and revered soul, in the service of our Cambridge University and of our intellectual society for so many years, as one that was never swamped in the "worse than Serbonian bog" of the materialism that has in the last generation so invaded some of the European and other schools, but rose ever into the heaven of personal verities, of which the ethereal orbits he loved to contemplate were to him but types. He was a scientist, if any one deserves that name, but a philosopher too, and rather of the ideal than utilitarian stamp; for although not blind to the benefits of science, more than was Francis Bacon, or is the last machinist or engineer, understanding perfectly how ships are guided by hints from the starry sweep through the firmament,

which he himself surveyed at midnight more than at noonday, and how they are guarded from destruction by the Coast Survey, on which with the lamented Bache he was engaged, to save many a vessel from wreck by showing every rock and quicksand more precisely on the chart, he yet had and would share with others the more intense and immortal joy of purely contemplating the truth which is, in its own glory, divinely good. In phyllotaxy, or that special arrangement of the stems on a plant which the planets in the solar system repeat, in immense and splendid illustration of the same law, he had a pleasure which all the harvests of the field could not afford. Having heard a fine oration on the importance of business and business men in the economy of life, he insisted on making the balance true by putting the ideal element of pure thought in the other scale. Who that heard but must have admired his address at the Chestnut-street Club, in which he likened the spinning of the stars to that of an earthly parent's twirling a top for the amusement of his little boy, thus taking up a wooden toy into the solar spaces and Milky Way where the Father of all fatherhood launches the mighty orbs from their centre to please his offspring, as the balls immeasurable and imponderable by man whirl around on the ethereal floor? If, he said, in a nebula or fire-mist was the origin of the sun and all his attendant primaries and satellites, the nebula itself was no vague, void, and thoughtless substance, but had a plan, and involved all in it that was to be evolved out of it, as much as an acorn or an egg. That great thinker, Chauncey Wright, considered the past and future of the outward universe so uncertain and indeterminable, — that is, he was so anti-dogmatic, with all his wisdom and profound insight, — that he called the whole *cosmic weather*, like the changing, unpredictable clouds and winds. Peirce saw the stability, mid all the shifting, in the immutable mind of God, of which, as the Rock of Ages, he was glad humbly to speak. If to his exposition of the laws of light and motion objection was made, he had no ambition to reply, but had an unperturbed dignity in resting on and trusting in the truth. Said the sublime discoverer Kepler, "I think God's thoughts after him." Peirce, with the prophet Isaiah, was conscious of the rapture of feeling God had thought his human thoughts before him, and that, in some sense, the Everlasting One had weighed and meted out the globes and their huge ellipses, even as does the mortal investigator, however feebly the latter follows the wisdom and love that presided at the genesis and birth of all.

It is this reverent quality in Benjamin Peirce which is the motive of my discourse, and without which none of his surpassing attainments in his explo-

ration, by numbers, of the constitution of things would induce me to celebrate him in this place ; and I am incited by this character of his mind because, in my judgment, by the temporary setting-in of materialism in speculators of the contentious and imperious sort, we are likely, if but for a while, to be put back in all those immaterial values that distinguish and ennoble our nature. The oration, last summer, of Dr. Storrs at Cambridge showed us the "more excellent way." Nevertheless, the main tendency, the current theory (for it is theory, and not Socratically reasoned truth) runs otherwise, and would inform or convince us that all comes up from the earth, and that there is no heaven but this external sky whence aught can come down. Even the spirits *materialize* in the dusky circles now! Like the silt and deposit, by which lakes and creeks are filled up yonder, and the ocean slowly retires from the coast, so a grosser element is the mental sand or mud by which the river of God is made shallow, and the old sea of faith and truth pushed back, to send no more tidings to dwellers in these earthly bounds. The idol of experience is put for the deity of spirit and life. "In matter," says Mr. Tyndall, "we see the promise and potency of all the forms of life." But whence, save from an original, essential, and boundless life or being, arose the possibility of any and all the living forms? Which, matter or spirit, is first, highest, best? or are they simultaneous and but diverse names of the same thing? In this discussion, the lists drawn and the battle set, Peirce did not hesitate, but took unequivocally and fervently the spiritual side. After listening to him for an hour, who but was persuaded of the superiority of mind, of reason, of love, to all else, and that nought, as he instructed us, could get beyond the beauty and power of a child's prayer taught by a mother at her little one's cot or crib? I own, for one, I was refreshed and cheered out of all despondency or distrust by this pattern of a man whose idea and whose self was an overweight for all the tremendous spheres that had been the theme of his lucid and familiar talk, and which he could imaginatively hand round as little specimens to be examined by his class.

As he knew the being of God, so he held to the immortality of the soul, and naturally; for what is composed of, will be resolved into, dust. But the offspring of spirit will outlive this form of flesh. It is the survival of the fittest, beyond any present animal or vegetable cases Darwin cites.

This faith in him was less a scientific deduction than an instinct, intuition, tradition, and consciousness of religious feeling, although his science contradicted not, but was consonant therewith. He shared it with Agassiz, as Dr. Edward H. Clarke told me, — Agassiz, his friend and intellectual equal, with

whom he walked between Boston and Cambridge, and talked by the way. He doubted not he should, out of this body, continue the studies which his friend with the microscope and himself with the telescope had begun; and Agassiz was of the same mind. He thought some point in the constellation Hercules would furnish a good and favorable post whence his observations might be carried on! As one wants to look around any object of interest, to behold a mountain on the other side, or see the interior of some temple of Vesta, or Arch of Titus with the "golden candlestick" from Jerusalem which was the spoil of war, so he coveted (and has he not reached?) another station from which to survey the stars. Is this not so much a conclusion of logic, as a sentiment of hope? It is not, therefore, less stable and trustworthy for the human soul, in which all noble sentiments are co-ordinate powers with the pure intellect, and, at least, of not inferior worth.

But I think the pious confidence was born in him, and came from his stock, and the strain of his blood. He was a kinsman, a nephew, of Ichabod Nichols, whom he strongly resembled, — my own minister, a true divine and man of genius, one like Coleridge inspired in monologue, and of whom Jonathan Phillips told me that Channing, after listening to his brother on a certain occasion, declared that Nichols was superior in strength to himself, and he could have written no such discourse. It is to Nichols, more than any one out of the house of my own kith and kin, that I am in debt for the first awakening of my mind to a sense of its destiny in the grandeur of Christian truth; and, if I have ever kindled another mind with the same sacred fire, the flame was transmitted as from torch to torch and headland to headland in ancient Greece. My preacher and pastor was an enthusiast, while a rationalist; and I lighted my candle from his ever-burning wick. It is the master in him which the scholar feels is his best gift, whether he paint, sing, play, or discourse; for the true master ends in giving the scholar to himself. The chief part of my poor faculty was from my partaking my teacher's tone and method, and my pleasure in this particular service of to-day is enhanced by the association of the names of Peirce and Nichols in my own memory and thought.

What a winsome and gracious, as well as powerful presence, like his uncle's, was that of Benjamin Peirce! The long soft locks turning to iron-gray, the sweet and sober face, the gentle voice with no harsh guttural note, the impressive brow in which the causal and the ideal forces and organs both strove and both prevailed, the manner alike of loftiness and lowliness, as of one who knew whereof he affirmed, yet deferred to whatever Wisdom had to

offer from any other mouth, — are not these among the traits of the picture which death has photographed in the recollection of all his friends? What has become of the head, so subtle in its processes and manifold, so imaginative and so abstruse, at home with arithmetical and rhetorical figures alike, that could contract its scrutiny to the most minute and vanishing point, and yet had room for the broad revolutions of the skies? What has become of that? Is it dust? If so, then it is dust that praises God! Despite David's doubting inquiry, sepulchres are monuments, not only to mortals, but to the Most High. But the dweller has gone from this slight, curious, convoluted, and bone-protected rotunda of a house, — whither, who knows? or why should we wish with detail of circumstance now to comprehend? Was the abode made for the inmate, or the inmate for the abode? Can the occupant not move into another mansion, when, in this clay hut, it has notice to quit? I refer the question to the Builder, above as below, if you think by his inspiration he has not replied.

Had the "Mécanique Celeste" an author, and the celestial mechanism none which gave its title to the book? or shall the human author perish while the book remains? It were as natural to think, that, while the geometry of the heavens abides, the great Geometer is dead. If the particles made me, when they separate I may not be. But, if I draw or my author wove them for my earthly dress, finer particles may serve me in another form and state; and I should as soon think the atoms had made God as that they could fashion a human soul.

This, then, is the lesson of the life and character of the astronomer and geometrician, Benjamin Peirce: even a faith we cannot demonstrate or argue into existence, as like some American or African river it takes its rise in distant lakes or mountains unseen from these lower plains, yet which cannot be argued down! I therefore exhort you to revere, as he did, the moral nature, your own religious constitution and spiritual frame. He believed in the simple unity of God, and enduring substance of the soul. But he is too great to be claimed by any denomination or sect, and is one of those models of humanity by which all the heats of parties are rebuked, a member of that church which is society, and has no articles or forms, any more than do the angels, those pure flames of love. Let us add his monument, his memory, to that of Bowditch, and of all who have been as famous for virtue as for knowledge; and, in humble spheres, let us emulate the faithfulness which makes all deeds of equal worth, as the smallest vessels sail on the great parallels of the sea.

I prize my witness; for Benjamin Peirce was a healthy mind, with no itch of vanity or tumor of pride, although he had that elevation of humility which cannot be distinguished either from self-respect or a respect for other men. His bearing was that of a noble among nobles, who do not credit any thing base. We sometimes see a personal beauty, which we think God must mean to last forever, however hereafter it may be suited with a different and more fitting dress. How much higher claim has beauty of disposition and thought; and into what loftier degrees than any sacred story ever recorded it may yet rise! As the thrifty rice-bird of the South, bent on eating, is the singing bobolink of the Northern spring, flying and chanting at once, let us hope for our nature a transformation, of which the feathered chorister is but a type.

BENJAMIN PEIRCE: [1]

ASTRONOMER, MATHEMATICIAN.

1809–1880.

For him the Architect of all
Unroofed our planet's starlit hall;
Through voids unknown to worlds unseen
His clearer vision rose serene.

With us on earth he walked by day,
His midnight path how far away!
We knew him not so well who knew
The patient eyes his soul looked through;

For who his untrod realm could share
Of us that breathe this mortal air,
Or camp in that celestial tent
Whose fringes gild our firmament?

How vast the workroom where he brought
The viewless implements of thought!
The wit how subtle, how profound,
That Nature's tangled webs unwound;

That through the clouded matrix saw
The crystal planes of shaping law,
Through these the sovereign skill that planned, —
The Father's care, the Master's hand!

[1] From the *Atlantic Monthly*, by permission of Messrs. Houghton, Mifflin, & Co.

To him the wandering stars revealed
The secrets in their cradle sealed :
The far-off, frozen sphere that swings
Through ether, zoned with lucid rings ;

The orb that rolls in dim eclipse,
Wide wheeling round its long ellipse, —
His name Urania writes with these,
And stamps it on her Pleiades.

We knew him not ? Ah ! well we knew
The manly soul, so brave, so true,
The cheerful heart that conquered age,
The child-like, silver-bearded sage.

No more his tireless thought explores
The azure sea with golden shores :
Rest, wearied frame ! the stars shall keep
A loving watch where thou shalt sleep.

Farewell ! the spirit needs must rise,
So long a tenant of the skies, —
Rise to that home all worlds above
Whose sun is God, whose light is love.

OLIVER WENDELL HOLMES.

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